

**SAMPLING ANALYSIS PLAN
SITE CHARACTERIZATION OF
BOWMANS POND (PAC-700-1108) AND STEAM
CONDENSATE HOLDING TANKS (IHSS 139.1N)**

**Revision No. 0
Document Control No: RF/RMRS-98-296**

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April 1999**

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**Document Classification
Review Waiver Per
Classification Office
CEX-010-98**

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APPENDIX

- A Required Detection Limits (18 Pages)
- B Field Forms (2 Pages)

LIST OF ACRONYMS

| | |
|-------|--|
| ALF | Action Levels and Standards Framework |
| ASD | Analytical Services Division |
| APD | Analytical Projects Office |
| CDPHE | Colorado Department of Public Health and Environment |
| DOE | US Department of Energy |
| DQO | Data Quality Objective |
| EPA | Environmental Protection Agency |
| ERM | Environmental Restoration Management |
| FO | Field Operations |
| GT | Geotechnical |
| GPS | Global Positioning System |
| IDM | Investigative Derived Material |
| IHSS | Individual Hazardous Substance Site |
| KH | Kaiser-Hill Company, Inc. |
| mg/Kg | milligrams per kilogram |
| mg/L | milligrams per Liter |
| nCi/g | Nanocuries Per Gram |
| NFA | No Further Action |
| OU | Operable Unit |
| OVM | Organic Vapor Meter |
| pCi/g | Picocuries Per Gram |
| pCi/L | Picocuries Per Liter |
| PAC | Potential Area of Concern |
| PARCC | Precision, Accuracy, Representativeness, Completeness, and Comparability |
| PCB | Polychlorinated Biphenyl |
| PCOC | Primary Contaminant of Concern |

| | |
|--------|--|
| POE | Point of Evaluation |
| QAPD | Quality Assurance Project Description |
| QA | Quality Assurance |
| QC | Quality Control |
| RFI/RI | Resource Conservation and Recovery Act Facilities Investigation/Remedial Investigation |
| RFCA | Rocky Flats Cleanup Agreement |
| RFETS | Rocky Flats Environmental Technology Site |
| RMRS | Rocky Mountain Remediation Services, L.L.C. |
| ROD | Record of Decision |
| RPD | Relative Percent Difference |
| SAP | Sampling Analysis Plan |
| SOP | Standard Operating Procedure |
| SOW | Statement of Work |
| SVOC | Semivolatile Organic Compound |
| SW | Surface Water |
| SWD | Soil and Water Database |
| ug/L | Micrograms per Liter |
| ug/Kg | Micrograms per Kilogram |
| VOC | Volatile Organic Compound |

STANDARD OPERATING PROCEDURES

| NUMBER | PROCEDURE TITLE |
|----------------------------|---|
| Procedure No. FO.1, Rev. 3 | Air Monitoring and Particulate Control |
| 5-21000-OPS-FO.03 | Field Decontamination Procedures |
| RMRS/OPS-PRO.112 | Handling of Decontamination Water and Wash Water |
| RMRS/OPS-PRO.128 | Handling and Containerizing Drilling Fluids and Cuttings |
| 4-K55-ENV-OPS-FO.10 | Receiving, Marking, and Labeling Environmental Materials Containers |
| 5-21000-OPS-FO.11 | Field Communications |
| RMRS/OPS-PRO.141 | Decontamination Facility Operations |
| RMRS/OPS-PRO.069 | Containing, Preserving, Handling and Shipping of Soil and Water Samples |
| 5-21000-OPS-FO.15 | Photoionization Detectors and Flame Ionization Detectors |
| RMRS/OPS-PRO.101 | Logging Alluvial and Bedrock Material |
| RMRS/OPS-PRO.117 | Plugging and Abandonment of Boreholes |
| RMRS/OPS-PRO.102 | Borehole Clearing |
| RMRS/OPS-PRO.126 | Surface Water Data Collection Activities |
| RMRS/OPS-PRO.081 | Surface Water Sampling |
| RMRS/OPS-PRO.085 | Pond Sampling |
| RMRS/OPS-PRO.064 | Pond and Reservoir Bottom Sediment Sampling |
| 1-F20-ER-EMR-EM.001 | Approval Process for Construction/Excavation Activities |
| 2-S47-ER-ADM-05.14 | Use of Field Logbooks and Forms |
| RF/RMRS-98-200 | Evaluation of Data for Usability in Final Reports |
| 1-50000-ADM-12.01 | Control of Measuring and Test Equipment |
| 3-21000-ADM-17.01 | Quality Assurance Records Requirements |
| RMRS-QAPD-001 | RMRS Quality Assurance Program Description |
| 1-C88-WP1027-NONRAD | Non-Radioactive Waste Packaging |
| 1-M12-WO4034 | Radioactive Waste Packaging Requirements |
| 4-C77-WO-1101 | Solid Radioactive Waste Packaging |
| 1-C80-WO-1102-WRT | Waste/Residue Traveler Instructions |
| PADC-96-00003 | WSRIC for OU Operations, Version 6.0, Section No. 1 |
| 1-PRO-079-WGI-001 | Waste Characterization, Generation, and Packaging |

1.0 INTRODUCTION

This Sampling Analysis Plan (SAP) for the characterization of Bowmans Pond and Individual Hazardous Substance Site (IHSS) 139.1N (i.e., the steam condensate tanks [T-107 and T-108]) summarizes the existing data, delineates data gaps, and describes the sampling methodology, project organization, quality assurance, and schedule required to characterize potential contamination of soil, sediment, and surface water. Bowmans Pond is referenced as Potential Area of Concern (PAC) 700-1108 at the Rocky Flats Environmental Technology Site (RFETS). The two steam condensate tanks (T-107 and T-108), are referenced as part of IHSS 139.1N. Contamination will be measured against the Action Levels and Standards Framework (ALF) for Surface Water, Ground Water, and Soils of the Rocky Flats Cleanup Agreement (RFCA) (DOE, 1996) or by the Applicable or Relevant and Appropriate Requirements (ARARs) established for the Industrial Area. Based on the available data Bowmans Pond is ranked 28th and IHSS 139.1N is ranked 60th on the Environmental Restoration Ranking of priority sites (RMRS, 1998). Together, these sites and the surrounding area, comprise the depositional environment for the Building 700 area effluent. This project will be performed in accordance with the applicable Federal, State, and local regulations, as well as DOE Orders, RFETS policies and procedures, and Environmental Restoration Operating Procedures.

1.1 Background

Bowmans Pond and IHSS 139.1N are located north of Building 774 (Figure 1.1). Bowmans Pond consists of a small depression approximately 3 to 4 feet (ft) deep with an areal extent of approximately 28 ft by 33 ft (Figure 1.2). Previous investigations indicate that Bowmans Pond surface water and sediments have been impacted by run off from the area upgradient of the pond and water received from a storm drain and footing drains from Buildings 771 and 774. Additionally, releases to Bowmans Pond resulting from the steam condensate tanks (IHSS 139.1N) and a process waste line leak are discussed in the Historical Release Report (DOE, 1992). T-107 and T-108 are aboveground tanks with a capacity of 8,000-gallons. The riveted steel tanks received overflow and contained liquid from a bermed area around a sodium hydroxide product tank located immediately south of Building 774 (Figure 1.2). The tank bottoms are badly corroded (DOE, 1992). Overflow from Bowmans Pond to the tank area has also potentially affected the tank area.

The analytical data available to characterize releases to Bowmans Pond are presented in the Draft Operable Unit (OU) 8 Investigation of Footing Drains-Technical Memorandum No. 1 (EG&G, 1994) and Draft OU 8 Data Summary Technical Memorandum No. 2 (EG&G, 1995). Surface water monitoring station SW086, located down gradient of Bowmans pond, provides analytical

data to characterize water quality from Bowmans Pond (Figure 1.2). A sump located adjacent to SW086 diverted Bowmans Pond water to Solar Pond 207C, however, it can not be verified by site visits or interviews with RFETS personnel if the sump is operational or has been operational since 1990. The Solar Evaporation Ponds Interceptor Trench System (ITS) was installed in 1980 and 1981 and collects groundwater via drain tiles located in the eastern portion of the investigation area (Figure 1.3).

1.2 Data Summary

Existing data for surface water, the Building 771 and 774 footing drains, sediment, surface soil, and groundwater from locations in the vicinity of Bowmans Pond, and IHSS 139.1(N) were compiled for use in identifying the potential contaminants of concern (PCOCs) and data gaps to be addressed by this SAP. The maximum concentration of each analyte detected is presented in Tables 1.2.1 through 1.2.5 for each medium.

1.2.1 Surface Water

Analytical results for surface water samples from monitoring locations SW084, SW086, and SW124 are presented in Table 1.2.1. As illustrated on Figure 1.2, SW084 and SW124 are upgradient of the pond and may be indicative of inflow to the pond from the surrounding area. SW086 is located downgradient of the pond, and although data are limited, can be used to estimate water quality from Bowmans Pond. The maximum concentrations detected at these locations were compared to surface water action levels and standards for the Segment 5, Point of Evaluation (POE) provided in Attachment 5 of RFCA (DOE, 1996). Analytes with maximum concentrations exceeding the referenced action levels are bolded in Table 1.2.1 and represent PCOCs.

1.2.2 Footing Drains

The footing drain and storm drain waters from Buildings 771 and 774 (and the 700 Area in general) have been routinely released to Bowmans pond and, as a result, represents a potential source of contamination to the pond and surrounding area as illustrated in Figure 1.2. Analytes detected in samples collected from footing drain FD-774-1 previous to and during the OU 8 investigation (EG&G, 1994) is presented in Table 1.2.2. Comparability in the occurrence and concentrations of tritium, lead, chromium, copper, strontium, and zinc between surface water and the footing drain water is noted. Analyte concentrations appear to decrease between the 1989 and the 1993 sampling events. No flow was observed in footing drain FD-774-2 during the sampling events.

Table 1.2.1 Summary of Maximum Analytical Results – Surface Water

| Location | Date | Description | Result | Unit | Action Level, Segment 5 POE |
|----------|----------|------------------------|---------|-------|--------------------------------|
| SW086 | 4/16/90 | 1,1,1-Trichloroethane | 5 | ug/L | 200 |
| SW084 | 5/8/89 | Acetone | 110 | ug/L | 3650 |
| SW124 | 4/17/91 | Aroclor-1254 | 12 | ug/L | 1 ^a |
| SW084 | 4/11/89 | Beryllium | 3.6 | ug/L | 4 |
| SW084 | 3/20/90 | Carbon Tetrachloride | 130 | ug/L | 5 |
| SW084 | 3/20/90 | Chloroform | 40 | ug/L | 6 |
| SW084 | 12/19/89 | Chromium | 298 | ug/L | 50 |
| SW084 | 12/19/89 | Cobalt | 13.7 | ug/L | NA |
| SW084 | 12/19/89 | Copper, total | 216 | ug/L | 16 (dissolved) ^b |
| SW084 | 7/17/90 | Cyanide | 3 | ug/L | 5 |
| SW084 | 12/19/89 | Lead, total | 189 | ug/L | 6.5 (dissolved) ^b |
| SW084 | 6/26/90 | Lithium | 1170 | ug/L | NA |
| SW084 | 12/19/89 | Nickel, total | 171 | ug/L | 123 (dissolved) ^b |
| SW086 | 6/6/89 | Nitrate/Nitrite | 25 | mg/L | 100 (10) ^c |
| SW086 | 7/11/88 | Oil & Grease | 253 | mg/L | NA |
| SW084 | 6/26/90 | Strontium | 5850 | ug/L | NA |
| SW086 | 4/16/90 | Tetrachloroethene | 5 | ug/L | 5 |
| SW086 | 9/10/90 | Toluene | 10 | ug/L | 1000 |
| SW084 | 12/19/89 | Zinc | 2970 | ug/L | 141 |
| SW084 | 2/16/90 | Am-241 | 3.9 | pCi/L | 0.15 ^d |
| SW086 | 10/10/90 | Pu-239/240 | 0.5424 | pCi/L | 0.15 ^d |
| SW086 | 5/7/90 | Sr-89/90 | 9855 | pCi/L | 8 ^d |
| SW086 | 9/10/90 | Tritium | 1188.96 | pCi/L | 500 ^d |
| SW084 | 5/7/90 | U-233/234 ^f | 7.98 | pCi/L | 10 ^{d,e} |
| SW086 | 1/25/90 | U-235 | 0.31 | pCi/L | 10 ^{d,e} |
| SW086 | 5/7/90 | U-238 ^f | 6.58 | pCi/L | 10 ^{d,e} |

Note: Bolded analytes equal or exceed Segment 5, Point of Evaluation (POE) action levels.

a) The practical quantitation limit (PQL) for aroclor-1254 (1 ug/L) is greater than the action level (0.5 ug/L). Per RFCA, the action level defaults to the PQL.

b) Measured concentration is for an unfiltered sample; the action level is for a filtered sample.

c) 100 mg/L is an interim standard

d) The action level is a site-specific standard for Walnut Creek

e) The action level is for a total U measurement rather than isotopic

f) Adding the U-233/234 and U-238 activities for the sample collected from 5/7/90 results in a total activity exceeding the action level

Table 1.2.2 Summary of Maximum Foundation Drain Analytical Results, FD 774-1

| Date | Description | Result | Units | Action Level, Segment 5 POE |
|---------|---------------------|--------|-------|--------------------------------|
| Jun-80 | Tritium | 4,681 | pCi/L | 500 |
| Jun-80 | Nitrate as Nitrogen | 108.5 | mg/L | 100 |
| 4/26/89 | Lead | 363 | ug/L | 6.5 (dissolved) |
| 4/26/89 | Chromium | 54 | ug/L | 50 |
| 4/26/89 | Copper | 360 | ug/L | 16 (dissolved) |
| 4/26/89 | Nickel | 71 | ug/L | 123 (dissolved) |
| 4/26/89 | Strontium | 700 | ug/L | NA |
| 4/26/89 | Zinc | 7,300 | ug/L | 141 |
| 3/27/93 | Lead | 6 | ug/L | 6.5 (dissolved) |
| 3/27/93 | Chromium | <5 | ug/L | 50 |
| 3/27/93 | Copper | 12 | ug/L | 16 (dissolved) |
| 3/27/93 | Nickel | <13 | ug/L | 123 (dissolved) |
| 3/27/93 | Strontium | 274 | ug/L | NA |
| 3/27/93 | Zinc | 154 | ug/L | 141 |

Note: Bolded analytes equal or exceed Segment 5, Point of Evaluation (POE) action levels. No VOCs or SVOCs were detected in March 1993 sampling event.

1.2.3 Sediment and Surface Soil

Sediment monitoring location SED124 corresponds with surface water monitoring location SW124 (Figure 1.2) and is located upgradient of Bowmans Pond. The analytical results for SED124 are presented on Table 1.2.3. The results indicate elevated levels of the PCB aroclor-1254 and benzo(a)pyrene as compared to RFCA Tier II surface soil action levels for the Industrial Area. Radionuclides are observed in the range of 0.1 to 2.2 pCi/g. Tritium, measured in the interstitial water from the sediment samples, was observed at a maximum of 794.7 pCi/L.

Five sediment samples (SED80293 through SED80693) were collected from around the two steam condensate tanks as part of the OU 8 Phase I RFI/RI as shown in Figure 1.2 (EG&G, 1995). These five sediment samples were only analyzed for metals and VOCs with no positive results above the Tier II ALF values for the respective analytes (EG&G, 1995).

Table 1.2.3 Summary of Maximum Historical Analytical Results – Sediment (SED124)

| Date | Description | Result | Unit | Surface Soil/Industrial | |
|----------|----------------------|------------------|-------|-------------------------|---------|
| | | | | Tier II | Tier I |
| 3/25/91 | 4-Nitroaniline | 5.3 | mg/Kg | NA | NA |
| 3/25/91 | Americium-241 | 0.8585 | pCi/g | 38 | 209 |
| 3/25/91 | Anthracene | 2.9 | mg/Kg | 613,000 | 613,000 |
| 12/17/90 | Antimony | 7 | mg/Kg | 818 | 818 |
| 3/25/91 | Aroclor-1254 | 67 | mg/Kg | 0.743 | 74.3 |
| 4/16/91 | Arsenic | 5.1 ^a | mg/Kg | 3.27 | 327 |
| 3/25/91 | Benzo(a)Anthracene | 7.1 | mg/Kg | 7.84 | 784 |
| 3/25/91 | Benzo(a)Pyrene | 6.3 | mg/Kg | 0.784 | 78.4 |
| 3/25/91 | Benzo(b)Fluoranthene | 7.1 | mg/Kg | 7.84 | 784 |

Table 1.2.3 – Continued

| | | | | | |
|----------|------------------------|--------------------|-------|----------|----------|
| 3/25/91 | Benzo(ghi)Perylene | 5.7 | mg/Kg | NA | NA |
| 3/25/91 | Benzo(k)Fluoranthene | 6.3 | mg/Kg | 78.4 | 7840 |
| 8/20/91 | Beryllium | 0.86 | mg/Kg | 1.33 | 133 |
| 4/16/91 | Cesium-134 | 0.1187 | pCi/g | NA | NA |
| 12/17/90 | Chromium | 49.5 | mg/Kg | >1E+6 | >1E+6 |
| 3/25/91 | Chrysene | 8.2 | mg/Kg | 784 | 78400 |
| 9/19/90 | Dibenzo(a,h)Anthracene | 1.2 | mg/Kg | 0.784 | 78.4 |
| 3/25/91 | Indeno(1,2,3-cd)Pyrene | 5 | mg/Kg | 7.84 | 784 |
| 3/25/91 | Phenanthrene | 16 | mg/Kg | NA | NA |
| 3/25/91 | Plutonium-239/240 | 1.129 | pCi/g | 252 | 1088 |
| 3/25/91 | Pyrene | 19 | mg/Kg | 61300 | 613 |
| 4/16/91 | Radium-226 | 2.2 | pCi/g | 0.0247 | 2.47 |
| 4/16/91 | Selenium | 0.94 | mg/Kg | 1.02E+04 | 1.02E+04 |
| 4/16/91 | Strontium | 53 | mg/Kg | >1E+6 | >1E+6 |
| 3/25/91 | Strontium-89,90 | 0.1378 | pCi/g | 57.2 | 5720 |
| 3/25/91 | Tritium | 794.7 ^b | pCi/L | 44800 | 4.48E+06 |

Note: Bolded analytes exceed relevant Tier II surface soil action level for Industrial Use.

- a) The arsenic concentration is above the action level but is below background.
b) Tritium value exceeds surface water action level; Tritium sample collected from interstitial water from sediment sample.

As a result of the elevated aroclor-1254 concentration detected at SED124 (67,000 ug/Kg), PCB occurrence in the area was investigated further as part of a follow up investigation in May 1991. Sample locations are shown on Figure 1.2 and the results are summarized in Table 1.2.4 (EG&G, 1991). A maximum concentration of 8,700 ug/Kg aroclor-1254 was observed at site PCB-31-13 on the northwest (or west) side of Bowmans Pond (Figure 1.2). Overall, seven of the samples have aroclor-1254 concentrations above the Tier II ALF for aroclor-1254.

Table 1.2.4 PCB Analytical Results, May 1991

| Location | Aroclor-1254 (ug/Kg) |
|-----------------|----------------------|
| PCB31-6 | 25 |
| PCB31-7 | 33 |
| PCB31-8 | < 21 |
| PCB31-9 | 230 |
| PCB31-10 | 1,500 |
| PCB31-11 | 3,700 |
| PCB31-12 | 1,600 |
| PCB31-13 | 8,700 |
| PCB31-14 | 4,300 |
| PCB31-15 | 220 |
| PCB31-16 | 2,300 |
| PCB31-17 | 1,800 |

Note: < = Analyte not detected at or above the listed method reporting limit, (EG&G, 1991). Bolded sample locations indicate the analyte exceeded the Tier II action level for aroclor-1254, which is 743 ug/Kg.

1.2.4 Groundwater

Groundwater data in the vicinity of Bowmans Pond and T-107 and T108 is limited. The maximum concentration of analytes detected from November 1993 through June 1998 from monitoring well P219189, which is located upgradient of Bowmans Pond (Figure 1.2), are presented in Table 1.2.5. Only results for Volatile Organic Compounds (VOCs) and tritium were available.

The Solar Pond Interceptor Trench System (ITS) (Draft Solar Ponds Plume Decision Document, 1999) captures a portion of the groundwater downgradient from Bowmans Pond and the two Steam Condensate Tanks (Figure 1.3).

Table 1.2.5 Summary of Maximum Analytical Results – Groundwater (Well P219189)

| Date | Description | Result | Units | Tier II | Tier I |
|----------|-----------------------------|--------|-------|---------|---------|
| 11/18/93 | 1,1,1-Trichloroethane | 12 | ug/L | 200 | 20000 |
| 6/15/98 | 1,1,2-Trichloroethane | 1 | ug/L | 5 | 500 |
| 11/18/93 | 1,1-Dichloroethane | 58 | ug/L | 1,010 | 101000 |
| 11/18/93 | 1,1-Dichloroethene | 49 | ug/L | 7 | 700 |
| 2/8/94 | 1,2-Dichloroethane | 0.3 | ug/L | 5 | 500 |
| 8/10/94 | 1,2-Dichloropropane | 0.7 | ug/L | 5 | 500 |
| 6/15/98 | Carbon Tetrachloride | 7 | ug/L | 5 | 500 |
| 6/15/98 | Chloroform | 2 | ug/L | 100 | 10000 |
| 6/15/98 | Cis-1,2-Dichloroethene | 1 | ug/L | 70 | 700 |
| 6/15/98 | Methylene Chloride | 2 | ug/L | 5 | 500 |
| 11/20/95 | Nitrate/Nitrite | 0.92 | ug/L | 10000 | 1000000 |
| 6/15/98 | Tetrachloroethene | 0.6 | ug/L | 5 | 500 |
| 8/10/94 | Trichloroethene | 0.4 | ug/L | 5 | 500 |
| 8/10/94 | Tritium | 990 | pCi/L | 666 | 66600 |

Note: Bolded analytes exceed Tier II groundwater action levels.

1.2.5 Summary

Table 1.2.6 represents a summary of the PCOCs identified using the available data. Although not well characterized, the data indicates that the Bowmans Pond and IHSS 139.1N area is a depositional environment for effluent from the Building 700 area. Further, the recipient area is contaminated with aroclor-1254 above action levels in several media of concern and potentially contaminated with radionuclides, heavy metals, VOCs, and semivolatile organics. An "NA" on Table 1.2.6 indicates that the medium has not been analyzed for that particular parameter. The most significant data gap for the site is surface soil and subsurface soil. Surface soil in the area has only been characterized for PCBs and subsurface soil has not been sampled. Additionally, given the age of the analytical results presented for surface water, sediments, and surface soil, these samples likely are not representative of current conditions at in the area. The data are not sufficient to characterize the extent or magnitude of the contamination at the site; therefore, future

decisions regarding the disposition of Bowmans Pond and IHSS 139.1 (N) area (e.g., accelerated action, interim action, no further action) cannot be made.

Groundwater contamination, observed in well P219189, is a result of upgradient sources from the Industrial Area. Groundwater actions will be addressed by the Industrial Area Interim Management/ Interim Remedial Action (IM/IRA).

Table 1.2.6 Summary of Available Data and Resulting PCOCs by Medium for Bowmans Pond and IHSS 139.1 (N)

| PCOC | Media | | | | |
|----------------------|---------------|---------------|----------|--------------|-------------|
| | Surface Water | Footing Drain | Sediment | Surface Soil | Groundwater |
| Aroclor-1254 | X | NA | X | X | NA |
| Benzo(a)pyrene | ND | ND | X | NA | NA |
| Carbon Tetrachloride | X | ND | ND | NA | X |
| Chloroform | X | ND | ND | NA | ND |
| Chromium | X | X | X | NA | NA |
| Copper | X | X | ND | NA | NA |
| Lead | X | X | ND | NA | NA |
| Nickel | X | X | ND | NA | NA |
| Nitrate | X | X | ND | NA | NA |
| 1,1-DCE | ND | ND | ND | NA | X |
| Tetrachloroethene | X | ND | ND | NA | ND |
| Zinc | X | X | ND | NA | NA |
| Am-241 | X | NA | X | NA | NA |
| Pu-239/-240 | X | NA | X | NA | NA |
| Ra-226 | ND | NA | X | NA | NA |
| Sr-89/-90 | X | NA | X | NA | NA |
| Tritium | X | NA | X | NA | NA |

Note: X = Data is available, NA = No data available, ND = Data indicates no detection's.

1.3 Hydrogeologic and Contaminant Setting

Bowmans Pond and the steam condensate tanks are located on a northward sloping colluvial surface consisting of approximately 10 to 11 ft of gravelly to sandy clay and clay. Top of bedrock is approximately 11 ft below ground surface (bgs) and consists of claystone of the Laramie Formation as observed in the boring log from P219189 (Figure 1.2). Groundwater is observed to range between 6 and 8 ft. bgs in well P219189. Groundwater flows toward the north towards the apex of North Walnut Creek. The depth of sediment in Bowmans Pond is unknown and will be evaluated during this investigation.

Figure 1.2 depicts the footing drains and storm drains from the 700 area that daylight at Bowmans Pond and lead out from Bowmans Pond towards North Walnut Creek. Based on the location of Bowmans Pond and the surrounding area in general, the investigation area is considered a receptor and depositional environment for the Building 700 area effluent.

1.4 Objectives

The objective of this investigation is to characterize the nature and extent of contamination in surface soil, sediment, subsurface soil and surface water in the depositional environment for the Building 700 area effluent (Figure 1.2). The study area encompasses both Bowmans Pond and IHSS 139.1N. The existing characterization data are not sufficient to disposition the site as an accelerated action, interim action, or no further action.

Specifically, the objectives of the investigation are to:

- Characterize contamination of surface water and sediments in influents to and effluents from Bowmans Pond and Bowmans Pond itself
- Determine the nature and extent of contamination in surface soil and subsurface soil for the surrounding depositional environment which encompasses the area adjacent to Bowmans Pond and IHSS 139.1N

As indicated in Section 1.2.5, samples of surface water, sediment, surface soil, and subsurface soil analyzed for the PCOCs (PCBs, metals, VOCs, SVOCs, PCBs, and isotopic radionuclides) are necessary to estimate the extent and magnitude of contamination. Characterization data collected will be of sufficient and defensible (validated and verified) quality to disposition the site for further action or NFA.

2.0 SAMPLING RATIONALE AND DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) to meet the objectives described in Section 1.4 were developed based upon review of available analytical data (Section 1.2). Establishing requirements for the characterization involve identifying the decisions to be made, as well as the data needed to make these decisions. Implementation of EPA's DQO process is necessary to determine the data needs for the project and to optimize the number and types of measurements and analyses relative to the available resources and ultimate project decisions. The DQO process is a systematic means to ensure that data collected, either historical or newly acquired, is legally and technically defensible so that decisions based on the data will, likewise, be legally and technically defensible.

2.1 State the Problem

Historical data indicate potential contamination of the Bowmans Pond area as a result of receiving incidental storm water and footing drain effluent from the 700 area for the past 40 years.

The most significant data gap for the site is the lack of characterization data for surface soil and subsurface soil. Additionally, the samples available for surface water and sediment data are not representative of current site conditions in the area. The data are not sufficient to characterize the extent or magnitude of the contamination at the site; therefore, future decisions regarding the disposition of Bowmans Pond and IHSS 139.1 (N) area (e.g., accelerated action, interim action, no further action) cannot be made.

2.2 Identify the Decision

Sample data collected by this effort will be used to:

- Identify contaminants of concern (COCs)
- Characterize the extent or magnitude of contamination in surface water, sediment (surface soil), and subsurface soil (i.e. PCOCs) with respect to Tier 1 and/or Tier II action levels.
- Disposition the Bowmans pond and IHSS 139.1(N) site(s) for either further action warranted or propose as No Further Action per RFCA and HRR processes.

Actions based on the decision include an evaluation, remedial action, or management action of soils or surface water identified as exceeding Tier I action levels or the Segment 5 Point of Evaluation (POE) action levels for surface water. Actions based on the decision may also include an evaluation or management action of soils or surface water identified as not equal to or exceeding Tier I action levels but exceeding Tier II action levels or the Segment 5 Point of Evaluation (POE) for surface water. Actions based on the decision may also include an evaluation or management action of soils or surface water identified as less than Tier II action levels or the Segment 5 Point of Evaluation (POE) for surface water.

2.3 Identify Inputs to the Decision

Inputs to the decision include:

- The concentration of analytical data obtained from surface water, sediment, surface soil, and subsurface soil samples with respect to analysis for PCBs, total metals, VOCs (subsurface only), SVOCs, and isotopic radionuclides. Samples for pH will be collected from surface soil adjacent to the steam condensate tanks.
- RFCA Action Levels

To identify the contaminants of concern for the site, surface soil and sediment concentrations will be compared to the Tier I and Tier II surface soil action levels established under RFCA guidance. Subsurface soil concentrations will be compared to the Tier I subsurface action levels and

surface water concentrations will be compared to the action levels from the nearest Point of Evaluation, Segment 5 (RFCA). Methods with quantitation limits (organics) and minimum detectable activities (MDAs) below action level thresholds were selected.

Appendix A provides low-range quantitation limits for PCOCs suspected to be present within the Investigation Area. *It is understood that Tier I action levels for subsurface VOCs may be revised and Tier II action levels may be established on the basis of ongoing negotiations to lower subsurface soil action levels and protect surface waters.*

2.4 Define the Investigation Boundaries

The investigation boundaries are illustrated horizontally in Figures 1.2 and 3.1 and vertically in Section 3.1. These boundaries are considered representative of the depositional environment for the Building 700 area effluent. The boundary encompassing both Bowmans Pond and IHSS 139.1(N) may be modified if preliminary data warrant such action.

2.5 Develop a Decision Rule

2.5.1 Surface Water

Decision rules for surface water are as follows:

- If measurements in surface water for any contaminant exceed Segment 5 POE Surface Water Action Levels, a remedial or management action must be taken.
- If measurements in surface water for any contaminant do not equal or exceed Segment 5 POE Surface Water Action Levels, the surface water will be recommended for NFA.

2.5.2 Sediments and Soils

Decision rules for sediments and soils are as follows:

- If measurements in soils for any contaminant exceed Tier I action levels (as defined in ALF), subsurface soil sources will be removed and surface soils will be remediated or managed as appropriate.
- If measurements in soils for any contaminant exceed Tier II action levels (as defined in ALF), surface soils will be managed in an appropriate manner and subsurface soils will be evaluated to determine if either a remedial or management action is necessary to protect surface water and ecological resources.

- If measurements in subsurface soil for all contaminants are below Tier II action levels (as defined in ALF), the soils will be recommended for NFA.
- If preliminary data are observed to exceed the above mentioned action levels and it can be demonstrated that the exceedance is not due to laboratory contamination, the investigation boundaries may be expanded by a distance of 25 feet downgradient to further delineate the extent of migration.

2.6 Specify Limits on Decision Errors

A subjective and judgmental sampling plan is designed to delineate the nature and extent of contamination based on source terms of the effected media. Field decisions to expand the investigation boundary by adding step-out grids will be made upon receipt of expedited data for the project. Preliminary analytical data will be assessed in accordance with verification of blank samples. If the blank contains detectable levels of common laboratory contaminants, then the samples will be considered positive "hits" only if the concentrations exceed ten times the maximum amount in the Blank.

2.7 Optimization of Design

Eleven surface soil/sediment and subsurface sample collection locations are spatially located to adequately characterize the investigation area. Sample collection locations have been randomly selected on the basis of: 1) influent areas; 2) center of the pond; 3) effluent area; and 4) depositional areas located down gradient of the pond. Two surface water sampling events will be performed to compare water quality parameters with previous water quality parameters. One surface water sampling event will be performed during normal base level conditions and a second surface water sampling event will be performed during a storm water runoff event. For each event, three surface water samples will be collected from the locations specified in Section 3.2. If data gaps are identified as the investigation progresses or subsequent to the collection of all samples as described, this SAP will be modified and additional samples will be collected as needed to adequately characterize the investigation area. Analytical data collected in support of this SAP will be evaluated using the guidance established in Evaluation of Data for Usability in Final Reports (RF/RMRS-98-200).

3.0 SAMPLING ACTIVITIES AND METHODOLOGY

Potential contamination of the investigation area will be evaluated using soil corings of pond sediment, and surface water sampling techniques.

3.1 Soil Borings and Pond Sediment Sampling

Locations for collection of surface soil and subsurface soil were subjectively selected as described in Section 2.7. Sampling for surface soil (from 0.0 to 0.6-ft) and subsurface soil (from greater than 0.6-ft) will be conducted at 11 locations in the investigation area (Figure 3.1).

Sampling methodology will consist of hand held soil corings to a depth of approximately 3.0 to 4.0-ft or until native colluvial material is encountered as determined in the field. Soil cores will be collected using a hand held, zero contamination, driver corer as described in procedure RMRS/OPS-PRO.064, Pond and Reservoir Bottom Sediment Sampling. Table 3.1 presents the number of coreholes/sampling events, real investigative samples, and quality control samples to be collected during this investigation. Table 3.2 summarizes the analytical program for the investigation. Several attempts at the same location may be required to fulfill the sample volume requirements.

Approximate sample intervals (ft) are as follow:

- 0.0 - 0.6, Composite sample for metals, SVOCs, pesticides/PCBs, tritium, rad screen and radionuclides. Sample for pH at the two coreholes adjacent to the two steam condensate tanks.
- 0.6 - 1.5, Composite sample for metals, SVOCs, pesticides/PCBs, tritium, rad screen and radionuclides.
- 1.5 - 2.0, Grab sample for VOCs.
- 2.0 - 3.5, Composite sample for metals, SVOCs, pesticides/PCBs, tritium, rad screen and radionuclides.
- 3.5 - 4.0, Grab sample for VOCs.

Table 3.1 Field Program

| Media | Number of Boreholes/Events | REAL Samples | Duplicate Samples | Rinse Samples | Trip Blanks (VOC only) | Total Samples |
|---------------------------|----------------------------|--------------|-------------------|---------------|------------------------|---------------|
| Sediment/ Surface Soil | 11 | 11 | 1 | 1 | 1 | 14 |
| Subsurface Soil | 11 | 22 | 2 | 2 | 2 | 28 |
| Surface Water | 2 | 6 | 1 | 0 | 1 | 8 |

Note: Approximately 50 samples will be collected for radiological screening analysis for Department of Transportation shipping requirements.

Table 3.2 Analytical Program

| Media | Analytical Method | Analytes | Container | Preservative | Holding Time |
|--|-------------------------------|--|--|--|--|
| Surface Soil, Subsurface Soil, Surface Water | DOT Radiological Screen | Gross Alpha/Gross Beta | 60 or 125-ml wide mouth glass or poly jar for soil, 40-ml glass for water. | None | 6 months |
| Surface Soil, Subsurface Soil, Surface Water | Metals | TAL Metals, total | 125-ml wide mouth glass jar for soil. 1 x 1-L poly for water. | HNO ₃ pH < 2 for water Cool, 4° C | 6 months |
| Surface Water | Metals | TAL Metals, dissolved | 1 x 1-L poly. | HNO ₃ pH < 2 for water | 6 months |
| Surface Water | Oil and Grease | Oil and Grease | 1-L glass with Teflon liner. | H ₂ SO ₄ pH < 2, Cool, 4° C | 28 days |
| Surface Water | Radiological | Radionuclides, total | 1 x 4-L poly. | HNO ₃ for water | 6 months |
| Surface Water | Radiological | Radionuclides, dissolved | 1 x 4-L poly. | HNO ₃ for water | 6 months |
| Surface Water | Nitrate + nitrite as N | Nitrate/Nitrite | 250-ml poly or glass. | Cool, 4° C | 48 hr |
| Surface Soil, Subsurface Soil, Surface Water | Extractable Organics | Semivolatile Organic Compounds | 125-ml wide mouth glass jar, Teflon lined closure for soil. 3 x 1-L amber glass for water. | Cool, 4° C | 7 days for water, 14 days for soil until ext., and 40 days after for both |
| Surface Soil, Subsurface Soil, Surface Water | Pesticides and PCBs | Pesticides/Aroclors (PCBs) | 125-ml wide mouth glass jar, Teflon lined closure for soil. 2 x 1-L amber glass for water. | Cool, 4° C | 7 days for water, 14 days for soil until ext., and 40 days after for both |
| Surface Soil, Subsurface Soil, Surface Water | Tritium | Tritium | 500-ml wide mouth glass for soil. 125-ml glass for water. | None | None |
| Surface Soil, Subsurface Soil | Alpha Spectroscopy | Plutonium-239/240, Americium-241, Uranium Isotopes | 125-ml wide mouth glass or poly jar for soil, 1 x 4L poly for water. | None for soil, HNO ₃ for water | 6 months |
| Subsurface Soil, Surface Water | SW-846 Method 8260A | Volatile Organic Compounds | 120-ml capped core, 60 or 125-ml wide mouth glass jar, Teflon lined closure for soil. 3 x 40-ml glass, Teflon lined septa cap for water. | Cool, 4° C | 14 days |

SW-846 (EPA, 1986), Test Methods for Evaluating Solid Waste. RMRS/OPS-PRO.069; Containing, Preserving, Handling, and Shipping soil and Water Samples.

Radiological screening samples will be collected surficially and at depth (Table 3.1) to characterize the material for DOT shipping purposes. Samples for pH will also be collected from two sample locations immediately north of the steam condensate tanks. A total of four pH soil samples (two from each location) will be collected from composite intervals 0.6 to 1.5 and 2.0 to 3.5 ft. Sample coreholes will be logged according to procedure RMRS/OPS-PRO.101, Logging Alluvial and Bedrock Material. Coreholes will be abandoned by procedure RMRS/OPS-PRO.117, Plugging and Abandonment of Boreholes, except that coreholes will be backfilled with powdered or granular bentonite. Sampling locations will be identified with a unique location number and surveyed for location and elevation using GPS receivers or equivalent equipment.

3.2 Surface Water Sampling

Two surface water-sampling events are proposed to characterize surface water in Bowmans Pond, one during normal base level conditions and a second during a storm water runoff event. Three samples will be collected from each event at the locations shown in Figure 3.1. Surface water samples will be collected at the following locations: One sample from an inflow location (southwest corner of the pond); one from the center; and one from an outflow location (northeast corner of the pond) (Figure 3.1). Surface water samples will be collected as described in procedure RMRS/OPS-PRO.085, Pond Sampling (Section 5.4.2.2) for Small Pond Sampling from Shore. Surface water field parameters will be collected as described in procedure RMRS/OPS-PRO.081, Surface Water Sampling and recorded per procedure RMRS/OPS-PRO.126, Surface Water Data Collection Activities. Refer to Table 3.1 for the number of sampling events, real investigative samples, and quality control samples to be collected and Table 3.2 for the surface water analytical program. Field parameter measurements will also be taken during surface water sampling. Measurements will include sample temperature, Eh, pH, and specific conductance.

3.3 Sample Handling

The location and depth interval of surface and subsurface media, either soil or water, recovered during the course of this investigation will be recorded in the field log book. Surface water samples will be recorded on the Soil and Water Database SWDF_1100 Field Data Form. Location codes will be cross-indexed to appropriate sample location designations in the field logbook. Soil core and other material that is subject to only field screening will be identified by the sample location code and depth interval where the sample is obtained. Analytical samples will have Kaiser Hill-Analytical Services Division (KH-ASD) sample numbers and labels applied to the container in the field. A sample correlation form was prepared (Appendix B), to facilitate the documentation and correlation of the type of sample analysis, quality control samples, and

radiological screening samples. A block of location codes will be of sufficient size to include the entire number of possible locations scheduled and an additional twenty percent for potential additional locations. The KH-ASD database system (AST) will be used to manage the analytical data from the laboratories, which in turn will be accessed by the RMRS Soil and Water Database (SWD) for management and archival. Sample collection and handling will follow procedure RMRS/OPS-PRO.069, Containing, Preserving, Handling, and Shipping Soil and Water Samples. Radioactive samples (equal to or greater than 2 nCi/g) will be transported to offsite laboratories in accordance with hazardous materials transportation shipping requirements (49CFR 172, 172.101, 173.403, and 173.421) with the appropriate shipping memo.

3.4 Equipment Decontamination/Waste Handling

Reusable sampling equipment will be decontaminated in accordance with procedure FO.03, Field Decontamination Procedures. Decontamination waters generated during the project will be managed according to procedure RMRS/OPS-PRO.112, Handling of Decontamination Water and Wash Water with the exception that the water will be transferred directly to the Consolidated Water Treatment Facility.

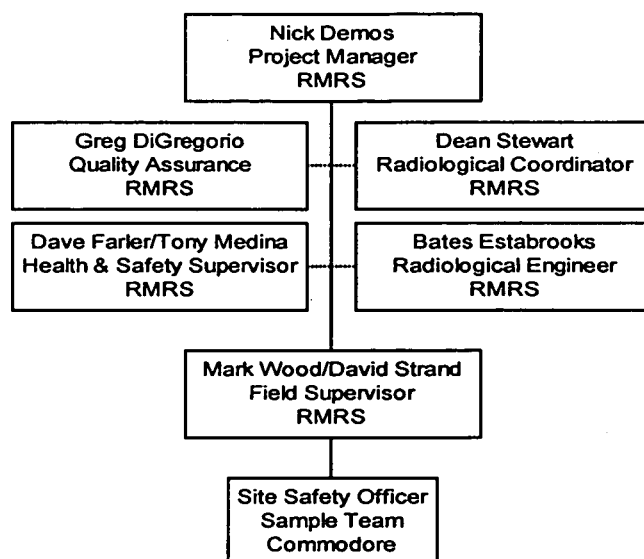
Residual soil will be handled in accordance with RMRS/OPS-PRO.128, Handling and Containerizing Drilling Fluids and Cuttings. Returned sample media will be managed in accordance with 1-PRO-079-WGI-001, "Waste Characterization, Generation, and Packaging. In the event that hazardous, low level, or mixed wastes are generated, project waste generators will generate, package, and manage the waste containers in accordance with plant procedures (1-C88-WP1027-NONRAD, "Non-Radioactive Waste Packaging"; 1-M12-WO4034, "Radioactive Waste Packaging Requirements"; 4-099-WO-1100, "Solid Radioactive Waste Packaging"; 1-C80-WO-1102-WRT, "Waste/Residue Traveler Instructions"; 1-PRO-079-WGI-001, "Waste Characterization, Generation, and Packaging; and the WSRIC for Operable Unit Operations, "Version 6.0, Section No. 1, PADC-96-00003).

4.0 PROJECT ORGANIZATION

Figure 4.1 illustrates the project organizational structure. The RMRS Characterization Projects Group project manager will be the primary point of responsibility for maintaining data collection and management methods that are consistent with site operations. Other organizations assisting with the implementation of this project are: RMRS Health and Safety, RMRS Quality Assurance, RMRS Radiological Engineering, RMRS Radiological Operations, Commodore Advanced Sciences, Inc., and KH-ASD.

The sampling personnel will be responsible for field data collection, documentation, and transfer of samples for analysis. Field data collections will include sampling and obtaining screening results. Documentation will require detailed field logs and completing appropriate forms for data management and chain-of-custody shipment. The RMRS project manager will coordinate sample shipment for on-site and off-site analyses through the ASD personnel. The sampling manager is responsible for verifying that chain-of-custody documents are complete and accurate before the samples are shipped to the analytical laboratories.

Figure 4.1
Bowmans Pond Characterization Project
Organizational Chart



5.0 QUALITY ASSURANCE

All components and processes within this project will comply with the RMRS Quality Assurance Program Description RMRS-QAPD-001, rev. 2, 4/15/98 (RMRS, 1998) which is consistent with the K-H Team QA Program (K-H, 1997). The RMRS QA Program is consistent with quality requirements and guidelines mandated by the EPA, CDPHE and DOE. In general, the applicable categories of quality control are as follows: Quality Program, Training, Quality Improvement, Documents and Records, Work Processes, Design, Procurement, Inspection/Acceptance Testing, Management Assessments, and Independent Assessments.

The project manager will be in direct contact with QA to identify and correct issues that potentially affect quality. Field sampling quality control will be conducted to ensure that data generated from all samples collected in the field for laboratory analysis represents the actual conditions in the

field. The confidence levels of the data will be maintained as described in Section 2.0 by the collection of QC and duplicate samples, equipment rinsate samples, and trip blanks.

The quality control (QC) samples for the project will include a 1 in 20 frequency for duplicate samples and equipment rinsates. Duplicate samples will be collected on a frequency of one duplicate sample for every twenty real samples. Rinsate samples will be generated at a frequency of one rinsate sample for every 20 real samples collected. Trip blanks will be generated at a frequency of one trip blank for every real VOC shipment and detections not associated with a trip blank will be considered real.

Data validation by a third party will be performed on 25% of the laboratory data according to the Rocky Flats ASD, Performance Assurance Group procedures. Samples will be randomly selected from adequate number of sample sets (RINS) by ASD personnel to fulfill data validation of 25% of the total number of analyses. The remaining 75% of the data will be verified. Table 5.1 provides the QA/QC samples and frequency requirements of QA sample generation.

Table 5.1 QA/QC Sample Type, Frequency, and Quantity

| Sample Type | Frequency | Comments | Quantity (estimated) |
|-------------|--|---|----------------------|
| Duplicate | One duplicate for each twenty real samples | | 4 |
| Rinse Blank | One rinse blank for each twenty real samples | To be performed with reusable sampling equipment following decontamination procedures | 3 |
| Trip Blank | One trip blank for each real VOC shipment | VOC analyses only | 4 |

Analytical data that is collected in support of the investigation will be evaluated using the guidance developed by Procedure RF/RMRS-98-200, Evaluation of Data for Usability in Final Reports. This procedure establishes the guidelines for evaluating analytical data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters.

A definition of PARCC parameters and the specific applications to the investigation are as follows:

Precision - A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference and the greater the precision. The relative percent difference (RPD) for results of duplicate and replicate samples will be tabulated according to matrix and analytical suites to compare for compliance with established precision DQOs. Specifications on repeatability are provided in Table 5.2. Deficiencies will be noted and qualified, if required. RPD goals for soils will be 40% for soils and 30% for water. The

duplicated error ratio for radionuclides will be +/- 1.96. Radiological precision is determined by comparing the Total Propagated Uncertainty (TPU) of the real versus duplicate, if the result is between +/- 1.96 then it is acceptable.

Accuracy- A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of a parameter. The closer the measurement to the true value, the more accurate the measurement. The actual analytical method and detection limits will be compared with the required analytical method and detection limits for VOCs and radionuclides to assess the DQO compliance for sensitivity. Sensitivities of analytical methods scheduled are listed in Appendix A.

Representativeness - A qualitative characteristic of data quality defined by the degree to which the data absolutely and exactly represent the characteristics of a population. Representativeness is accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest. The actual sample types and quantities will be compared with those stated in the SAP or other related documents and organized by media type and analytical suite. Deviation from the required and actual parameters will be justified.

Completeness - A quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. A completeness goal of 90% has been set for this SAP. The completion goal means that 90% of the data collected, analyzed, and verified will be of acceptable quality for decision making. Real samples and QC samples will be reviewed for the data usability and achievement of internal DQO usability goals. If sample data cannot be used, the non-compliance will be justified, as required.

Comparability - A qualitative measure defined by the confidence with which one data set can be compared to another. Comparability will be attained through consistent use of industry standards (e.g., SW-846) and standard operating procedures, both in the field and in laboratories. Statistical tests may be used for quantitative comparison between sample sets (populations). Deficiencies will be qualified, as required. Quantitative values for PARCC parameters for the project are provided in Table 5.2.

Table 5.2 PARCC Parameter Summary

| PARCC | Radionuclides | Non-Radionuclides |
|--------------------|--|--|
| Precision | Duplicate Error Ratio ≤ 1.96 | RPD $\leq 30\%$ for Water RPD $\leq 40\%$ for Soil |
| Accuracy | <ul style="list-style-type: none"> • Calibrations—Initial & Continuing • Lab Control Samples/Spikes (LCS) • Blanks (Method- or Equipment-) • Chemical Yield • Counting Time • Sensor Efficiency • Correction for Ingrowth Daughters | Comparison of Laboratory Control Sample Results with Real Sample Results |
| Representativeness | Based on SOPs and SAP | Based on SOPs and SAP |
| Comparability | Based on SOPs and SAP | Based on SOPs and SAP |
| Completeness | 90% Useable | 90% Useable |

6.0 SCHEDULE

The readiness assessment checklist for the project and the task-specific Health and Safety Plan will be completed prior to commencing field activities. Field activities are expected to begin in April and completed by May 1999. A data summary report will be completed by July 1999.

7.0 REFERENCES

- EG&G, 1991. Assessment of Known, Suspect, and Potential Environmental Releases of Polychlorinated Biphenyls (PCBs), Preliminary Assessment/Site Description, Rocky Flats Plant, Golden, CO., October.
- EG&G, 1992. Historical Release Report, Rocky Flats Plant, Golden, CO., January
- EG&G, 1994. Draft Final Investigations of Foundation Drains and Other Data Compilation, Addendum to the Operable Unit 8 Work Plan, 700 Area, Technical Memorandum No. 1, Rocky Flats Environmental Technology Site, Golden, CO., November.
- EG&G, 1995. Draft Final Operable Unit 8 Data Summary, Technical Memorandum No. 2, Rocky Flats Environmental Technology Site, Golden, CO., September.
- Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response, Washington, DC 20460.
- Department of Energy (DOE), 1996. Final Rocky Flats Cleanup Agreement, U.S. Department of Energy, Rocky Flats Environmental Technology Site, Golden, CO., July.
- Kaiser-Hill, 1997. Kaiser-Hill Team Quality Assurance Program, Rev. 4., Rocky Flats Environmental Technology Site, Golden, CO., August 1.
- Rocky Mountain Remediation Services, 1998. Environmental Restoration Ranking, Rocky Flats Environmental Technology Site, Golden, CO., September.

*Sampling Analysis Plan
Site Characterization of
Bowmans Pond (PAC-700-1108),
And Steam Condensate Tanks (IHSS 139.1N)*

*Document Number: RF/RMRS- 98-296
Revision: 0
Date: April 20, 1999
Page: 24 of 24*

Rocky Mountain Remediation Services, 1998. Site Wide Quality Assurance Program Description,
Rocky Flats Environmental Technology Site, Golden, CO.

INORGANIC METALS
REQUIRED DETECTION LIMITS

| RDL List ID Matrix Units | | RDL-1 ^(1,3) | | RDL-2 ^(1,3) | | RDL-3 ^(1,3) | |
|------------------------------------|------------------------|------------------------|-------|------------------------|-------|------------------------|-------|
| | | Aqueous | Solid | Aqueous | Solid | Aqueous | Solid |
| | | µg/L | mg/Kg | µg/L | mg/Kg | µg/L | mg/Kg |
| CAS No. | Element | | | | | | |
| 7429-90-5 | Aluminum | 17 | 3 | 200 | 40 | 200 | 40 |
| 7440-36-0 | Antimony | 3 | 1 | 60 | 12 | 60 | 12 |
| 7440-38-2 | Arsenic | 5 | 0.7 | 10 | 2 | 50 | 10 |
| 7440-39-3 | Barium | 100 | 20 | 100 | 20 | 100 | 20 |
| 7440-41-7 | Beryllium | 1 | 0.2 | 0.8 | 0.2 | 0.8 | 0.2 |
| 7440-43-9 | Cadmium | 1 | 0.1 | 5 | 1 | 5 | 1 |
| 7440-70-2 | Calcium | 5000 | 1000 | 5000 | 1000 | 5000 | 1000 |
| 7440-47-3 | Chromium | 2.0 | 0.4 | 2 | 0.4 | 10 | 2 |
| 7440-48-4 | Cobalt | 50 | 10 | 50 | 10 | 50 | 10 |
| 7440-50-8 | Copper | 3.0 | 0.6 | 25 | 5 | 25 | 5 |
| 7439-89-6 | Iron | 100 | 20 | 100 | 20 | 100 | 20 |
| 7439-92-1 | Lead | 2.0 | 0.4 | 3 | 0.6 | 50 | 10 |
| 7439-93-2 | Lithium | 100 | 20 | 100 | 20 | 100 | 20 |
| 7439-95-4 | Magnesium | 5000 | 1000 | 5000 | 1000 | 5000 | 1000 |
| 7439-96-5 | Manganese | 15 | 3 | 15 | 3 | 15 | 3 |
| 7439-97-6 | Mercury ⁽²⁾ | 0.10 | 0.20 | 0.10 | 0.20 | 0.10 | 0.20 |
| 7439-98-7 | Molybdenum | 30 | 6 | 30 | 6 | 200 | 40 |
| 7440-02-0 | Nickel | 20 | 5 | 40 | 8 | 40 | 8 |
| 7440-09-7 | Potassium | 5000 | 1000 | 5000 | 1000 | 5000 | 1000 |
| 7782-49-2 | Selenium | 3 | 2 | 5 | 1 | 80 | 16 |
| 7440-22-4 | Silver | 1 | 0.5 | 0.3 | 1 | 5 | 1 |
| 7440-23-5 | Sodium | 5000 | 1000 | 5000 | 1000 | 5000 | 1000 |
| 7440-24-6 | Strontium | 200 | 40 | 200 | 40 | 200 | 40 |
| 7440-28-0 | Thallium | 4 | 2 | 10 | 2 | 40 | 8 |
| 7440-31-5 | Tin | 200 | 40 | 200 | 40 | 200 | 40 |
| 11-09-6 | Uranium | NR | 40 | 200 | 40 | 200 | 40 |
| 7440-62-2 | Vanadium | 40 | 8 | 40 | 8 | 40 | 8 |
| 7440-66-6 | Zinc | 20 | 4 | 20 | 4 | 20 | 4 |

(1) If the sample concentration exceeds ten times IDL of the instrument or method in use, the value may be reported even though the IDL is greater than the RDL.

(2) Note that some Line Item Codes specified in Table C1 do not require mercury determinations.

(3) These RDLs are required for RFETS compliance requirements and pricing should reflect any multiple methods that are required to meet the RDLs required by the specified SSO5 LICs.

PESTICIDES AND PCBs
ROUTINE SW-846 METHODS

| Line Item Code: Approved Method Source: Matrices: | | SS03B003 | SS03B004 |
|---|-----------------------|-----------------------------|-----------------------------|
| | | SW-846 METHOD 8080A/8081 | SW-846 METHOD 8080A/8081 |
| | | Water | Soil, Sludge, Waste |
| CAS # | ANALYTE | RDL (ug/L) | RDL (ug/Kg) |
| 319-84-6 | alpha-BHC | 0.03 | 20 |
| 319-85-7 | beta-BHC | 0.06 | 40 |
| 319-86-8 | delta-BHC | 0.09 | 60 |
| 58-89-9 | gamma-BHC (Lindane) | 0.04 | 27 |
| 76-44-8 | Heptachlor | 0.03 | 20 |
| 309-00-2 | Aldrin | 0.04 | 27 |
| 1024-57-3 | Heptachlor epoxide | 0.08 | 54 |
| 959-98-8 | Endosulfan I | 0.02 | 14 |
| 60-57-1 | Dieldrin | 0.02 | 14 |
| 72-55-9 | 4,4-DDE | 0.04 | 27 |
| 72-20-8 | Endrin | 0.06 | 40 |
| 33213-65-9 | Endosulfan II | 0.04 | 27 |
| 72-54-8 | 4,4-DDD | 0.11 | 75 |
| 1031-07-8 | Endosulfan sulfate | 0.66 | 450 |
| 50-29-3 | 4,4-DDT | 0.12 | 80 |
| 72-43-5 | Methoxychlor | 1.80 | 1200 |
| 7421-93-4 | Endrin aldehyde | 0.23 | 155 |
| 12789-03-6 | Chlordane (technical) | 0.14 | 95 |
| 8001-35-2 | Toxaphene | 2.5 | 1700 |
| 12674-11-2 | Aroclor-1016 | 0.50 | 350 |
| 11104-28-2 | Aroclor-1221 | 0.50 | 350 |
| 11141-16-5 | Aroclor-1232 | 0.50 | 350 |
| 53469-21-9 | Aroclor-1242 | 0.50 | 350 |
| 12672-29-6 | Aroclor-1248 | 0.50 | 350 |
| 11097-69-1 | Aroclor-1254 | 0.50 | 350 |
| 11096-82-5 | Aroclor-1260 | 0.50 | 350 |

**RADIONUCLIDE TARGET ANALYTE LISTS AND REQUIRED DETECTION LIMITS (RDL)
AMERICIUM, PLUTONIUM, AND URANIUM**

| | | | | |
|----------------|-------------------------|-----------------|--------------------------------------|-----------------|
| | Line Item Code: | RC01B001 | RC01B002 | RC01B003 |
| | Matrices: | Water | Water Blank Corrected | Soil |
| | Reporting Units: | (pCi/l) | (pCi/l) | (pCi/g) |
| CAS No. | Isotope | RDL | RDL | RDL |
| 14596-10-2 | 241- Am | 0.03 | 0.03 | 0.3 |
| 10-12-8 | 239/240 Pu | 0.03 | 0.03 | 0.3 |
| 11-08-5 | 233/234 - U | 1.0 | 1.0 | 1.0 |
| 15117-96-1 | 235 - U | 1.0 | 1.0 | 1.0 |
| 7440-61-1 | 238 - U | 1.0 | 1.0 | 1.0 |

Module RC01-B.3

Isotopic Determinations by Alpha Spectrometry April 24, 1998 C-2

TRITIUM

| | | | |
|----------------|-------------------------|-----------------|-----------------|
| | Line Item Code: | RC02B001 | RC02B002 |
| | Matrices: | Water | Soil |
| | Reporting Units: | (pCi/l) | (pCi/g) |
| CAS No. | Isotope | RDL | RDL |
| 10028-17-8 | Tritium | 400 | 400 |

Module RC02-B.1

Tritium Analysis by LSC

SEMIVOLATILE ORGANICS TARGET COMPOUND LIST (TCL) AND REQUIRED DETECTION LIMIT

1. SEMIVOLATILE ORGANICS ANALYTE/REQUIREMENTS LISTS

The analyte lists which follow specify required analytes, required method sources, and required detection limits (RDLs).

TABLE C1 ROUTINE CLP METHODS

| Line Item Code: | | SS02B001 | SS02B002 |
|---|-------------------------------|---------------------------|----------------------------|
| Approved Method Source ⁽²⁾ : | | CLP-SOW | CLP-SOW Soil Method |
| Matrices: | | Water, Waste Water, | Soil, Sediment |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/kg) |
| 108-95-27 | Phenol | 10 | 330 |
| 111-44-4 | bis(2-Chloroethyl) ether | 10 | 330 |
| 95-57-8 | 2-Chlorophenol | 10 | 330 |
| 541-73-1 | 1,3-Dichlorobenzene | 10 | 330 |
| 106-46-7 | 1,4-Dichlorobenzene | 10 | 330 |
| 95-50-1 | 1,2-Dichlorobenzene | 10 | 330 |
| 95-48-7 | 2-Methylphenol | 10 | 330 |
| 108-60-1 | 2,2'-oxybis(1-Chloropropane)* | 10 | 330 |
| 106-44-5 | 4-Methylphenol | 10 | 330 |
| 621-64-7 | N-Nitroso-di-n-propylamine | 10 | 330 |
| 67-72-1 | Hexachloroethane | 10 | 330 |
| 98-95-3 | Nitrobenzene | 10 | 330 |
| 78-59-1 | Isophorone | 10 | 330 |
| 88-75-5 | 2-Nitrophenol | 10 | 330 |
| 105-67-9 | 2,4-Dimethylphenol | 10 | 330 |
| 111-91-1 | bis(2-Chloroethoxy) methane | 10 | 330 |
| 120-83-2 | 2,4-Dichlorophenol | 10 | 330 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 10 | 330 |
| 91-20-3 | Naphthalene | 10 | 330 |
| 106-47-8 | 4-Chloroaniline | 10 | 330 |
| 87-68-3 | Hexachlorobutadiene | 10 | 330 |
| 59-50-7 | 4-Chloro-3-methylphenol | 10 | 330 |
| 91-57-6 | 2-Methylnaphthalene | 10 | 330 |
| 77-47-4 | Hexachlorocyclopentadiene | 10 | 330 |
| 88-06-2 | 2,4,6-Trichlorophenol | 10 | 330 |
| 95-95-4 | 2,4,5-Trichlorophenol | 50 | 1600 |
| 91-58-7 | 2-Chloronaphthalene | 10 | 330 |
| 88-74-4 | 2-Nitroaniline | 50 | 1600 |
| 131-11-3 | Dimethylphthalate | 10 | 330 |

*Previously known by the name bis(2-Chloroisopropyl) ether.

TABLE C1 ROUTINE CLP METHODS (continued)

| Line Item Code: Approved Method Source ⁽²⁾ : Matrices: | | SS02B001 | SS02B002 |
|---|-----------------------------|---------------------------|----------------------------|
| | | CLP-SOW | CLP-SOW Soil Method |
| | | Water, Waste Water, | Soil, Sediment |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/kg) |
| 208-96-8 | Acenaphthylene | 10 | 330 |
| 606-20-2 | 2,6-Dinitrotoluene | 10 | 330 |
| 99-09-2 | 3-Nitroaniline | 50 | 1600 |
| 83-32-9 | Acenaphthene | 10 | 330 |
| 51-28-5 | 2,4-Dinitrophenol | 50 | 1600 |
| 100-02-7 | 4-Nitrophenol | 50 | 1600 |
| 132-64-9 | Dibenzofuran | 10 | 330 |
| 121-14-2 | 2,4-Dinitrotoluene | 10 | 330 |
| 84-66-2 | Diethylphthalate | 10 | 330 |
| 7005-72-3 | 4-Chlorophenyl-phenyl ether | 10 | 330 |
| 86-73-7 | Fluorene | 10 | 330 |
| 100-01-6 | 4-Nitroaniline | 50 | 1600 |
| 534-52-1 | 4,6-Dinitro-2-methylphenol | 50 | 1600 |
| 86-30-6 | N-nitrosodiphenylamine | 10 | 330 |
| 101-55-3 | 4-Bromophenyl-phenylether | 10 | 330 |
| 118-74-1 | Hexachlorobenzene | 10 | 330 |
| 87-86-5 | Pentachlorophenol | 50 | 1600 |
| 85-01-8 | Phenanthrene | 10 | 330 |
| 120-12-7 | Anthracene | 10 | 330 |
| 86-74-8 | Carbazole | 10 | 330 |
| 84-74-2 | Di-n-butylphthalate | 10 | 330 |
| 206-44-0 | Fluoranthene | 10 | 330 |
| 129-00-0 | Pyrene | 10 | 330 |
| 85-68-7 | Butylbenzylphthalate | 10 | 330 |
| 91-94-1 | 3,3'-Dichlorobenzidine | 10 | 330 |
| 56-55-3 | Benzo(a)anthracene | 10 | 330 |
| 218-01-9 | Chrysene | 10 | 330 |
| 117-81-7 | bis(2-ethylhexyl)phthalate | 10 | 330 |
| 117-84-0 | Di-n-octylphthalate | 10 | 330 |
| 205-99-2 | Benzo(b)fluoranthene | 10 | 330 |
| 207-08-9 | Benzo(k)fluoranthene | 10 | 330 |
| 50-32-8 | Benzo(a)pyrene | 10 | 330 |
| 193-39-5 | Indeno(1,2,3-cd)pyrene | 10 | 330 |
| 53-70-3 | Dibenz(a,h)anthracene | 10 | 330 |
| 191-24-2 | Benzo(g,h,i)perylene | 10 | 330 |

TABLE C2 ROUTINE SW-846 METHODS

| Line Item Code: Approved Method Source ⁽²⁾ : Matrices: | | SS02B008 | SS02B009 |
|---|------------------------------|---------------------------|-----------------------------|
| | | SW-846 METHOD 8270B | SW-846 METHOD 8270B |
| | | Water, Waste Water | Soil, Sediment, Waste |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/ Kg) |
| 108-95-27 | Phenol | 10 | 660 |
| 110-86-1 | Pyridine | 10 | 660 |
| 111-44-4 | bis(2-Chloroethyl) ether | 10 | 660 |
| 95-57-8 | 2-Chlorophenol | 10 | 660 |
| 541-73-1 | 1,3-Dichlorobenzene | 10 | 660 |
| 106-46-7 | 1,4-Dichlorobenzene | 10 | 660 |
| 100-51-6 | Benzy Alcohol | 20 | 1300 |
| 95-50-1 | 1,2-Dichlorobenzene | 10 | 660 |
| 95-48-7 | 2-Methylphenol | 10 | 660 |
| 39638-32-9 | bis(2-Chloroisopropyl) ether | 10 | 660 |
| 106-44-5 | 4-Methylphenol | 10 | 660 |
| 621-64-7 | N-Nitroso-di-n-propylamine | 10 | 660 |
| 67-72-1 | Hexachloroethane | 10 | 660 |
| 98-95-3 | Nitrobenzene | 10 | 660 |
| 78-59-1 | Isophorone | 10 | 660 |
| 88-75-5 | 2-Nitrophenol | 10 | 660 |
| 105-67-9 | 2,4-Dimethylphenol | 10 | 660 |
| 65-85-0 | Benzoic Acid | 50 | 3300 |
| 111-91-1 | bis(2-Chloroethoxy) methane | 10 | 660 |
| 120-83-2 | 2,4-Dichlorophenol | 10 | 660 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 10 | 660 |
| 91-20-3 | Naphthalene | 10 | 660 |
| 106-47-8 | 4-Chloroaniline | 20 | 1300 |
| 87-68-3 | Hexachlorobutadiene | 10 | 660 |
| 59-50-7 | 4-Chloro-3-methylphenol | 20 | 1300 |
| 91-57-6 | 2-Methylnaphthalene | 10 | 660 |
| 77-47-4 | Hexachlorocyclopentadiene | 10 | 660 |
| 88-06-2 | 2,4,6-Trichlorophenol | 10 | 660 |
| 95-95-4 | 2,4,5-Trichlorophenol | 10 | 660 |
| 91-58-7 | 2-Chloronaphthalene | 10 | 660 |
| 88-74-4 | 2-Nitroaniline | 50 | 3300 |
| 131-11-3 | Dimethylphthalate | 10 | 660 |
| 208-96-8 | Acenaphthylene | 10 | 660 |
| 99-09-2 | 3-Nitroaniline | 50 | 3300 |
| 83-32-9 | Acenaphthene | 10 | 660 |
| 51-28-5 | 2,4-Dinitrophenol | 50 | 3300 |

TABLE C2 ROUTINE SW-846 METHODS (continued)

| Line Item Code: Approved Method Source ⁽²⁾ : Matrices: | | SS02B008 | SS02B009 |
|---|-----------------------------|---------------------------|-----------------------------|
| | | SW-846 METHOD 8270B | SW-846 METHOD 8270B |
| | | Water, Waste Water | Soil, Sediment, Waste |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/ Kg) |
| 100-02-7 | 4-Nitrophenol | 50 | 3300 |
| 132-64-9 | Dibenzofuran | 10 | 660 |
| 121-14-2 | 2,4-Dinitrotoluene | 10 | 660 |
| 606-20-2 | 2,6-Dinitrotoluene | 10 | 660 |
| 84-66-2 | Diethylphthalate | 10 | 660 |
| 7005-72-3 | 4-Chlorophenyl-phenyl ether | 10 | 660 |
| 86-73-7 | Fluorene | 10 | 660 |
| 100-01-6 | 4-Nitroaniline | 50 | 3300 |
| 534-52-1 | 4,6-Dinitro-2-methylphenol | 50 | 3300 |
| 86-30-6 | N-nitrosodiphenylamine | 10 | 660 |
| 101-55-3 | 4-Bromophenyl-phenylether | 10 | 660 |
| 118-74-1 | Hexachlorobenzene | 10 | 660 |
| 87-86-5 | Pentachlorophenol | 50 | 3300 |
| 85-01-8 | Phenanthrene | 10 | 660 |
| 120-12-7 | Anthracene | 10 | 660 |
| 84-74-2 | Di-n-butylphthalate | 10 | 660 |
| 206-44-0 | Fluoranthene | 10 | 660 |
| 129-00-0 | Pyrene | 10 | 660 |
| 85-68-7 | Butylbenzylphthalate | 10 | 660 |
| 91-94-1 | 3,3'-Dichlorobenzidine | 20 | 1300 |
| 56-55-3 | Benzo(a)anthracene | 10 | 660 |
| 117-81-7 | bis(2-ethylhexyl)phthalate | 10 | 660 |
| 218-01-9 | Chrysene | 10 | 660 |
| 117-84-0 | Di-n-octylphthalate | 10 | 660 |
| 205-99-2 | Benzo(b)fluoranthene | 10 | 660 |
| 207-08-9 | Benzo(k)fluoranthene | 10 | 660 |
| 50-32-8 | Benzo(a)pyrene | 10 | 660 |
| 193-39-5 | Indeno(1,2,3-cd)pyrene | 10 | 660 |
| 53-70-3 | Dibenz(a,h)anthracene | 10 | 660 |
| 191-24-2 | Benzo(g,h,i)perylene | 10 | 660 |

TABLE C3 APPENDIX IX SW-846 METHODS

| Line Item Code: Approved Method Source ⁽²⁾ Matrices: | | SS02B005 | SS02B006 |
|---|--|-----------------------------|------------------------------|
| | | SW-846 Method 8270B | SW-846 Method 8270B |
| | | Water, Waste Water, | Soil, Sediment, waste |
| CAS # | ANALYTE | RDL ^(1,3) (ug/L) | RDL ^(1,3) (ug/kg) |
| 83-32-9 | Acenaphthene | 10 | 660 |
| 208-96-8 | Acenaphthylene | 10 | 660 |
| 98-86-2 | Acetophenone | 10 | ND |
| 53-96-3 | 2-Acetylaminofluorene; 2-AAF | 20 | ND |
| 92-67-1 | 4-Aminobiphenyl | 20 | ND |
| 120-12-7 | Anthracene | 10 | 660 |
| 140-57-8 | Aramite | 20 | ND |
| 56-55-3 | Benzo[a]anthracene | 10 | 660 |
| 205-99-2 | Benzo[b]fluoranthene | 10 | 660 |
| 207-08-9 | Benzo[k]fluoranthene | 10 | 660 |
| 191-24-2 | Benzo[ghi]perylene | 10 | 660 |
| 50-32-8 | Benzo[a]pyrene | 10 | 660 |
| 100-51-6 | Benzyl alcohol | 20 | 1300 |
| 101-55-3 | 4-Bromophenyl phenyl ether | 10 | 660 |
| 85-68-7 | Butylbenzylphthalate | 10 | 660 |
| 106-47-8 | 4-Chloroaniline | 20 | 1300 |
| 510-15-6 | Chlorobenzilate | 10 | ND |
| 59-50-7 | p-Chloro-m-cresol | 20 | 1300 |
| 91-58-7 | 2-Chloronaphthalene | 10 | 660 |
| 95-57-8 | 2-Chlorophenol | 10 | 660 |
| 7005-72-3 | 4-Chlorophenyl phenyl ether | 10 | 660 |
| 218-01-9 | Chrysene | 10 | 660 |
| 2303-16-4 | Diallate | 10 | ND |
| 53-70-3 | Dibenz[a,h]anthracene | 10 | 660 |
| 132-64-9 | Dibenzofuran | 10 | 660 |
| 84-74-2 | Di-n-butyl phthalate | 10 | ND |
| 95-50-1 | o-Dichlorobenzene | 10 | 660 |
| 541-73-1 | m-Dichlorobenzene | 10 | 660 |
| 106-46-7 | p-Dichlorobenzene | 10 | 660 |
| 91-94-1 | 3,3'-Dichlorobenzidine | 20 | 1300 |
| 120-83-2 | 2,4-Dichlorophenol | 10 | 660 |
| 87-65-0 | 2,6-Dichlorophenol | 10 | ND |
| 84-66-2 | Diethyl phthalate | 10 | 660 |
| 297-97-2 | IO,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin | ND | ND |
| 60-51-5 | Dimethoate | 20 | ND |
| 60-11-7 | p-(Dimethylamino)azobenzene | 10 | ND |

TABLE C3 APPENDIX IX SW-846 METHODS (continued)

| Line Item Code: Approved Method Source ⁽²⁾ : Matrices: | | SS02B005 | SS02B006 |
|---|-------------------------------------|-----------------------------|------------------------------|
| | | SW-846 Method 8270B | SW-846 Method 8270B |
| | | Water, Waste Water, | Soil, Sediment, waste |
| CAS # | ANALYTE | RDL ^(1,3) (ug/L) | RDL ^(1,3) (ug/kg) |
| 57-97-6 | 7,12-Dimethylbenz[a]anthracene | 10 | ND |
| 119-93-7 | 3,3'-Dimethylbenzidine | 10 | ND |
| 122-09-8 | alpha, alpha-Dimethylphenethylamine | ND | ND |
| 105-67-9 | 2,4-Dimethylphenol | 10 | 660 |
| 131-11-3 | Dimethyl phthalate | 10 | 660 |
| 99-65-0 | m-Dinitrobenzene | 20 | ND |
| 534-52-1 | 4,6-Dinitro-o-cresol | 50 | 3300 |
| 51-28-5 | 2,4-Dinitrophenol | 50 | 3300 |
| 121-14-2 | 2,4-Dinitrotoluene | 10 | 660 |
| 50606-20-2 | 2,6-Dinitrotoluene | 10 | 660 |
| 117-84-0 | Di-n-octyl phthalate | 10 | 660 |
| 122-39-4 | Diphenylamine | 50 | ND |
| 298-04-4 | Disulfoton | 10 | ND |
| 62-50-0 | Ethyl methanesulfonate | 20 | ND |
| 52-85-7 | Famphur | 20 | ND |
| 206-44-0 | Fluoranthene | 10 | 660 |
| 86-73-7 | Fluorene | 10 | 660 |
| 118-74-1 | Hexachlorobenzene | 10 | 660 |
| 87-68-3 | Hexachlorobutadiene | 10 | 660 |
| 77-47-4 | Hexachlorocyclopentadiene | 10 | 660 |
| 67-72-1 | Hexachloroethane | 10 | 660 |
| 70-30-4 | Hexachlorophene | 50 | ND |
| 1888-71-7 | Hexachloropropene | 10 | ND |
| 193-39-5 | Indeno(1,2,3-cd)pyrene | 10 | 660 |
| 465-73-6 | Isodrin | 20 | ND |
| 78-59-1 | Isophorone | 10 | 660 |
| 120-58-1 | Isosafrole | 10 | ND |
| 143-50-0 | Kepone | 20 | ND |
| 91-80-5 | Methapyrilene | 100 | ND |
| 56-49-5 | 3-Methylcholanthrene | 10 | ND |
| 66-27-3 | Methyl methanesulfonate | 10 | ND |
| 91-57-6 | 2-Methylnaphthalene | 10 | 660 |
| 298-00-0 | Methyl parathion; Parathion methyl | 10 | ND |
| 91-20-3 | Naphthalene | 10 | 660 |
| 130-15-4 | 1,4-Naphthoquinone | 10 | ND |
| 134-32-7 | 1-Naphthylamine | 10 | ND |

TABLE C3 APPENDIX IX SW-846 METHODS (continued)

| Line Item Code: Approved Method Source ⁽²⁾ : Matrices: | | SS02B005 | SS02B006 |
|---|--|-----------------------------|------------------------------|
| | | SW-846 Method 8270B | SW-846 Method 8270B |
| | | Water, Waste Water, | Soil, Sediment, waste |
| CAS # | ANALYTE | RDL ^(1,3) (ug/L) | RDL ^(1,3) (ug/kg) |
| 91-59-8 | 2-Naphthylamine | 10 | ND |
| 88-74-4 | o-Nitroaniline | 50 | 3300 |
| 99-09-2 | m-Nitroaniline | 50 | 3300 |
| 100-01-6 | p-Nitroaniline | 50 | ND |
| 98-95-3 | Nitrobenzene | 10 | 660 |
| 88-75-5 | o-Nitrophenol | 10 | 660 |
| 100-02-7 | p-Nitrophenol | 50 | 3300 |
| 56-57-5 | 4-Nitroquinoline 1-oxide | 40 | ND |
| 924-16-3 | N-Nitrosodi-n-butylamine | 10 | ND |
| 55-18-5 | N-Nitrosodiethylamine | 20 | ND |
| 62-75-9 | N-Nitrosodimethylamine | ND | ND |
| 86-30-6 | N-Nitrosodiphenylamine | 10 | 660 |
| 621-64-7 | N-Nitrosodipropylamine; Di-n-propylnitrosamine | 10 | 660 |
| 10595-95-6 | N-Nitrosomethylethylamine | ND | ND |
| 59-89-2 | N-Nitrosomorpholine | ND | ND |
| 100-75-4 | N-Nitrosopiperidine | 20 | ND |
| 930-55-2 | N-Nitrosopyrrolidine | 40 | ND |
| 99-55-8 | 5-Nitro-o-toluidine | 10 | ND |
| 56-38-2 | Parathion | 10 | ND |
| 608-93-5 | Pentachlorobenzene | 10 | ND |
| 82-68-8 | Pentachloronitrobenzene | 20 | ND |
| 87-86-5 | Pentachlorophenol | 50 | 3300 |
| 62-44-2 | Phenacetin | 20 | ND |
| 85-01-8 | Phenanthrene | 10 | 660 |
| 108-95-2 | Phenol | 10 | 660 |
| 106-50-3 | p-Phenylenediamine | 10 | ND |
| 298-02-2 | Phorate | 10 | ND |
| 109-06-8 | 2-Picoline | ND | ND |
| 23950-58-5 | Pronamide | 10 | ND |
| 129-00-0 | Pyrene | 10 | 660 |
| 94-59-7 | Safrole | 10 | ND |
| 95-94-3 | 1,2,4,5-Tetrachlorobenzene | 10 | ND |
| 58-90-2 | 2,3,4,6-Tetrachlorophenol | 10 | ND |
| 3689-24-5 | Tetraethyl dithiopyrophosphate; Sulfotepp | 40 | ND |
| 95-53-4 | o-Toluidine | 10 | ND |
| 120-82-1 | 1,2,4-Trichlorobenzene | 10 | 660 |

TABLE C3 APPENDIX IX SW-846 METHODS (continued)

| | | Line Item Code: | SS02B005 | SS02B006 |
|----------|---------------------------------|---|-----------------------------|------------------------------|
| | | Approved Method Source ⁽²⁾ : | SW-846 Method 8270B | SW-846 Method 8270B |
| | | Matrices: | Water, Waste Water, | Soil, Sediment, waste |
| CAS # | ANALYTE | | RDL ^(1,3) (ug/L) | RDL ^(1,3) (ug/kg) |
| 95-95-4 | 2,4,5-Trichlorophenol | | 10 | 660 |
| 88-06-2 | 2,4,6-Trichlorophenol | | 10 | 660 |
| 126-68-1 | O,O,O-Triethyl phosphorothioate | | ND | ND |
| 99-35-4 | sym-Trinitrobenzene | | 10 | ND |

TABLE C4 TCLP METHODS

| | | Line Item Code: | SS02B007 |
|----------|-----------------------|---|---------------------------|
| | | Approved Method Source ⁽²⁾ : | SW-846 Method 8270B |
| | | Matrices: | TCLP extracts |
| CAS # | ANALYTE | | RDL ⁽¹⁾ (ug/L) |
| 110-86-1 | Pyridine | | 50 |
| 106-46-7 | 1,4-Dichlorobenzene | | 50 |
| 95-48-7 | 2-Methylphenol | | 50 |
| 108-39-4 | 3-Methylphenol | | 50 |
| 106-44-5 | 4-Methylphenol | | 50 |
| 67-72-1 | Hexachloroethane | | 50 |
| 98-95-3 | Nitrobenzene | | 50 |
| 88-06-2 | 2,4,6-Trichlorophenol | | 50 |
| 95-95-4 | 2,4,5-Trichlorophenol | | 250 |
| 121-14-2 | 2,4-Dinitrotoluene | | 50 |
| 118-74-1 | Hexachlorobenzene | | 50 |
| 87-86-5 | Pentachlorophenol | | 250 |
| 87-68-3 | Hexachlorobutadiene | | 50 |

- (1) The RDLs are the required detection limits.
- (2) It is the responsibility of the Laboratory to assure that the method is appropriate to the sample matrix and to use the most recently promulgated version of the specified method source.
- (3) ND means achievable RDL's have not been determined.

VOLATILE ORGANICS TARGET COMPOUND LIST (TCL) AND REQUIRED DETECTION LIMIT

1. VOLATILE ORGANICS ANALYTE/REQUIREMENTS LISTS

The analyte lists which follow specify required analytes, the approved method source, and required detection limits (RDLs).

TABLE C1 ROUTINE CLP METHODS

| Line Item Code: Approved Method Source ⁽²⁾ : Matrices: | | SS01B001 | SS01B002 | SS01B003 |
|--|----------------------------|---------------------------|------------------------------------|---------------------------------------|
| | | CLP-SOW | CLP-SOW (Low Level Soil Method) | CLP-SOW (Medium Level Soil Method) |
| | | Water, Waste Water, | Soil, Sediment | Soil, Sediment |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/kg) | RDL ⁽¹⁾ (ug/kg) |
| 74-87-3 | Chloromethane | 10 | 10 | 1200 |
| 74-83-9 | Bromomethane | 10 | 10 | 1200 |
| 75-01-4 | Vinyl Chloride | 10 | 10 | 1200 |
| 75-00-3 | Chloroethane | 10 | 10 | 1200 |
| 75-09-2 | Methylene Chloride | 10 | 10 | 1200 |
| 67-64-1 | Acetone | 10 | 10 | 1200 |
| 75-15-0 | Carbon Disulfide | 10 | 10 | 1200 |
| 75-35-4 | 1,1-Dichloroethene | 10 | 10 | 1200 |
| 75-34-3 | 1,1-Dichloroethane | 10 | 10 | 1200 |
| 540-59-0 | 1,2-Dichloroethene (total) | 10 | 10 | 1200 |
| 67-66-3 | Chloroform | 10 | 10 | 1200 |
| 107-06-2 | 1,2-Dichloroethane | 10 | 10 | 1200 |
| 78-93-3 | 2-Butanone | 10 | 10 | 1200 |
| 71-55-6 | 1,1,1-Trichloroethane | 10 | 10 | 1200 |
| 56-23-5 | Carbon Tetrachloride | 10 | 10 | 1200 |
| 75-27-4 | Bromodichloromethane | 10 | 10 | 1200 |
| 78-87-5 | 1,2-Dichloropropane | 10 | 10 | 1200 |
| 10061-01-5 | cis-1,3-Dichloropropene | 10 | 10 | 1200 |
| 79-01-6 | Trichloroethene | 10 | 10 | 1200 |
| 124-48-1 | Dibromochloromethane | 10 | 10 | 1200 |
| 79-00-5 | 1,1,2-Trichloroethane | 10 | 10 | 1200 |
| 71-43-2 | Benzene | 10 | 10 | 1200 |
| 10061-02-6 | trans-1,3-Dichloropropene | 10 | 10 | 1200 |
| 75-25-2 | Bromoform | 10 | 10 | 1200 |
| 108-10-1 | 4-Methyl-2-pentanone | 10 | 10 | 1200 |
| 591-78-6 | 2-Hexanone | 10 | 10 | 1200 |
| 127-18-4 | Tetrachloroethene | 10 | 10 | 1200 |
| 108-88-3 | Toluene | 10 | 10 | 1200 |
| 79-34-5 | 1,1,2,2-Tetrachloroethane | 10 | 10 | 1200 |
| 108-90-7 | Chlorobenzene | 10 | 10 | 1200 |
| 100-41-4 | Ethyl Benzene | 10 | 10 | 1200 |
| 100-42-5 | Styrene | 10 | 10 | 1200 |
| 1330-20-7 | Xylenes (Total) | 10 | 10 | 1200 |

TABLE C2 ROUTINE SW-846 METHODS

| Line Item Code: | | SS01B004 | SS01B005 | SS01B006 | SS01B010 |
|---|---------------------------------------|--------------------------------|---------------------------|----------------------------|---|
| Approved Method Source ⁽²⁾ : | | SW-846 METHOD 8260 (Low Level) | SW-846 METHOD 8260 | SW-846 METHOD 8260 | Routine 24 Hour ⁽⁴⁾ SW-846 METHOD 8260 (Medium Level Soil Method) |
| Matrices: | | Water, Waste Water | Water, Aqueous Waste | Soil, Sediment, Waste | Soil, Sediment |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/kg) | RDL ⁽¹⁾ (ug/kg) |
| 75-71-8 | Dichlorodifluoromethane | 1 | 5 | 5 | 1200 |
| 74-87-3 | Chloromethane | 1 | 5 | 5 | 1200 |
| 74-83-9 | Bromomethane | 1 | 5 | 5 | 1200 |
| 75-01-4 | Vinyl Chloride | 1 | 5 | 5 | 1200 |
| 75-00-3 | Chloroethane | 1 | 5 | 5 | 600 |
| 75-69-4 | Trichlorofluoromethane | 1 | 5 | 5 | 600 |
| 76-13-1 | 1,1,2-Trichloro-1,2,2-trifluoroethane | 1 | 5 | 5 | 600 |
| 75-09-2 | Methylene Chloride | 1 | 5 | 5 | 600 |
| 67-64-1 | Acetone | 10 | 100 | 100 | 1200 |
| 75-15-0 | Carbon Disulfide | 1 | 5 | 5 | 600 |
| 75-35-4 | 1,1-Dichloroethene | 1 | 5 | 5 | 600 |
| 75-34-3 | 1,1-Dichloroethane | 1 | 5 | 5 | 600 |
| 156-60-5 | trans-1,2-Dichloroethene | 1 | 5 | 5 | 600 |
| 594-20-7 | 2,2-Dichloropropane | 1 | 5 | 5 | 600 |
| 156-59-2 | cis-1,2-Dichloroethene | 1 | 5 | 5 | 600 |
| 74-97-5 | Bromochloromethane | 1 | 5 | 5 | 600 |
| 67-66-3 | Chloroform | 1 | 5 | 5 | 600 |
| 107-06-2 | 1,2-Dichloroethane | 1 | 5 | 5 | 600 |
| 78-93-3 | 2-Butanone | 10 | 100 | 100 | 1200 |
| 71-55-6 | 1,1,1-Trichloroethane | 1 | 5 | 5 | 600 |
| 56-23-5 | Carbon Tetrachloride | 1 | 5 | 5 | 600 |
| 75-27-4 | Bromodichloromethane | 1 | 5 | 5 | 600 |
| 79-34-5 | 1,1,2,2-Tetrachloroethane | 1 | 5 | 5 | 600 |
| 78-87-5 | 1,2-Dichloropropane | 1 | 5 | 5 | 600 |
| 10061-02-6 | trans-1,3-Dichloropropene | 1 | 5 | 5 | 600 |
| 74-95-3 | Dibromomethane | 1 | 5 | 5 | 600 |
| 79-01-6 | Trichloroethene | 1 | 5 | 5 | 600 |
| 124-48-1 | Dibromochloromethane | 1 | 5 | 5 | 600 |
| 79-00-5 | 1,1,2-Trichloroethane | 1 | 5 | 5 | 600 |
| 563-58-6 | 1,1-Dichloropropene | 1 | 5 | 5 | 600 |
| 71-43-2 | Benzene | 1 | 5 | 5 | 600 |
| 10061-01-5 | cis-1,3-Dichloropropene | 1 | 5 | 5 | 600 |

TABLE C2 ROUTINE SW-846 METHODS (continued)

| Line Item Code: | | SS01B004 | SS01B005 | SS01B006 | SS01B010 |
|---|-----------------------------|--------------------------------|---------------------------|----------------------------|---|
| Approved Method Source ⁽²⁾ : | | SW-846 METHOD 8260 (Low Level) | SW-846 METHOD 8260 | SW-846 METHOD 8260 | Routine 24 Hour ⁽⁴⁾ SW-846 METHOD 8260 (Medium Level Soil Method) |
| Matrices: | | Water, Waste Water | Water, Aqueous Waste | Soil, Sediment, Waste | Soil, Sediment |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/kg) | RDL ⁽¹⁾ (ug/kg) |
| 75-25-2 | Bromoform | 1 | 5 | 5 | 600 |
| 591-78-6 | 2-Hexanone | 10 | 50 | 50 | 1200 |
| 108-10-1 | 4-Methyl-2-pentanone | 10 | 50 | 50 | 1200 |
| 142-28-9 | 1,3-Dichloropropane | 1 | 5 | 5 | 600 |
| 127-18-4 | Tetrachloroethene | 1 | 5 | 5 | 600 |
| 108-88-3 | Toluene | 1 | 5 | 5 | 600 |
| 108-90-7 | Chlorobenzene | 1 | 5 | 5 | 600 |
| 100-41-4 | Ethylbenzene | 1 | 5 | 5 | 600 |
| 100-42-5 | Styrene | 1 | 5 | 5 | 600 |
| 1330-20-7 | Xylenes (total) | 1 | 5 | 5 | 600 |
| 630-20-6 | 1,1,1,2-Tetrachloroethane | 1 | 5 | 5 | 600 |
| 106-93-4 | 1,2-Dibromoethane | 1 | 5 | 5 | 600 |
| 98-82-8 | Isopropylbenzene | 1 | 5 | 5 | 600 |
| 108-86-1 | Bromobenzene | 1 | 5 | 5 | 600 |
| 96-18-4 | 1,2,3-Trichloropropane | 1 | 5 | 5 | 600 |
| 103-65-1 | n-Propylbenzene | 1 | 5 | 5 | 600 |
| 95-49-8 | 2-Chlorotoluene | 1 | 5 | 5 | 600 |
| 106-43-4 | 4-Chlorotoluene | 1 | 5 | 5 | 600 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 1 | 5 | 5 | 600 |
| 98-06-6 | tert-Butylbenzene | 1 | 5 | 5 | 600 |
| 95-63-6 | 1,2,4-Trimethylbenzene | 1 | 5 | 5 | 600 |
| 135-98-8 | sec-Butylbenzene | 1 | 5 | 5 | 600 |
| 541-73-1 | m-Dichlorobenzene | 1 | 5 | 5 | 600 |
| 99-87-6 | 4-Isopropyltoluene | 1 | 5 | 5 | 600 |
| 106-46-7 | p-Dichlorobenzene | 1 | 5 | 5 | 600 |
| 95-50-1 | o-Dichlorobenzene | 1 | 5 | 5 | 600 |
| 104-51-8 | n-Butylbenzene | 1 | 5 | 5 | 600 |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 1 | 5 | 5 | 600 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 1 | 5 | 5 | 600 |
| 87-68-3 | Hexachlorobutadiene | 1 | 5 | 5 | 600 |
| 91-20-3 | Naphthalene | 1 | 5 | 5 | 600 |
| 87-61-6 | 1,2,3-Trichlorobenzene | 1 | 5 | 5 | 600 |

TABLE C8 SW846 METHOD 8015

| Line Item Code: | | SS01B013 | SS01B014 |
|---|----------|---------------------------|----------------------------|
| Approved Method Source ⁽²⁾ : | | SW-846 METHOD 8015 | SW-846 METHOD 8015 |
| Matrices: | | Water | Soil, Sludge, Waste |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/Kg) |
| 67-56-1 | Methanol | 25 | 250 |

TABLE C9 SW846 METHOD 8260 EXTENDED ANALYTE LIST

| Line Item Code: | | SS01B015 | SS01B016 |
|---|---------------------------------|----------------------------------|----------------------------------|
| Approved Method Source ⁽²⁾ : | | SW-846 METHOD 8260, | SW-846 METHOD 8260, |
| Matrices: | | Water | Soil, Sludge, Waste |
| CAS # | ANALYTE | RDL ⁽¹⁾ (ug/L) | RDL ⁽¹⁾ (ug/Kg) |
| 71-36-3 | n-Butyl alcohol | 50 | 50 |
| 78-83-1 | Isobutyl alcohol | 50 | 50 |
| 108-94-1 | Cyclohexanone | 50 | 50 |
| 141-78-6 | Ethyl acetate | 50 | 50 |
| 60-29-7 | Ethyl ether | 50 | 50 |
| CAS Numbers identified in Table C2 | All Analytes listed in Table C2 | RDLs for Line Item Code SS01*005 | RDLs for Line Item Code SS01*006 |

* denotes current module revision letter

- (1) The RDLs are the required detection limits.
- (2) It is the responsibility of the Laboratory to assure that the method is appropriate to the sample matrix and to use the most recently promulgated version of the specified method source.
- (3) Methods must comply with requirements of SW-846 Method 1311, Zero Headspace Method, for the analysis of volatile organics and with the RDLs listed above.
- (4) The required detection limits range from 0.6 to 1.2 mg/kg of soil. Any non-detects at this level do not require the low level soil method. Any concentrations higher than the analytical curve range shall be reported as estimated and shall be diluted and reanalyzed only at the request of the CTR. Exceptions include blanks and rinsate waters that will be analyzed using the low level method.

See SS01 Exhibit B, Section 2 for delivery schedule.

WATER QUALITY PARAMETERS REQUIREMENTS

1. WATER QUALITY PARAMETERS REQUIREMENTS LISTS

Table C1 and Table C2 specify required parameters, required detection limits (RDLs), required method sources and method type descriptions for each WQP line item code.

2. TABLE C1 AND TABLE C2, WATER QUALITY PARAMETERS

Table C1 WATER QUALITY PARAMETERS

| Line Item Codes | Parameter Identifier | Parameter Name | RDL ⁽¹⁾ (mg/L) | Approved Methods ⁽²⁾ | Method Type |
|-----------------|----------------------|---|---------------------------|--|--|
| SS06B001 | 10-70-8 | Acidity | 10 | EPA 305.1, SM 2310 | Titrimetric |
| SS06B002 | T-005 | Alkalinity, Total as CaCO ₃ | 10 | EPA 310.1, 310.2, SM 2320 B | Titrimetric (to pH 4.5) |
| SS06B003 | 71-52-3 | Alkalinity, Bicarbonate (HCO ₃ ⁻) as CaCO ₃ | 10 | EPA 310.1, 310.2, SM 2320 B | Titrimetric |
| SS06B004 | 3812-32-6 | Alkalinity, Carbonate (CO ₃ ²⁻) as CaCO ₃ | 10 | EPA 310.1, 310.2, SM 2320 B | Titrimetric |
| SS06B005 | 7727-37-9 | Ammonia as N | 0.1 | EPA 350.1, SM 4500-NH ₃ H | Colorimetric/Spectrophotometric (Automated-Phenate) |
| | | | | EPA 350.3, 4500-NH ₃ -F, G | Potentiometric (Ion Selective Electrode) |
| SS06B006 | 10-26-4 | Biochemical Oxygen Demand (BOD ₅) | 2 | HACH GRAPHICAL METHOD | Potentiometric (Dissolved Oxygen Depletion) |
| SS06B007 | 24959-67-9 | Bromide | 2 | EPA 300.0 | Ion Chromatography |
| | | | | EPA 320.1 | Titrimetric |
| SS06B008 | 11-03-0 | Carbonaceous Biochemical Oxygen Demand (CBOD ₅) | 2 | HACH GRAPHICAL METHOD | Potentiometric (Dissolved Oxygen Depletion with Nitrification Inhibitor) |
| SS06B009 | C-004 | Chemical Oxygen Demand (COD) | 5 | EPA 410.4, SM 5220 D | Colorimetric/Spectrophotometric |
| SS06B010 | 16887-00-6 | Chloride | 0.5 | EPA 300.0 | Ion Chromatography |
| | | | | EPA 325.3 | Titrimetric |
| SS06B011 | 18540-29-9 | Chromium VI (Hexavalent Cr) | 0.02 | EPA 218.4, SM3500-Cr D, SW-846 7196 A, | Colorimetric/Spectrophotometric |
| SS06B012 | 57-12-5 | Cyanide, Total | 0.005 | EPA 335.3, 335.4, SM4500-CN C, E | Colorimetric/Spectrophotometric (Manual Distillation followed by Analysis) |
| SS06B013 | 57-12-5 | Cyanide, Total, for RCRA Compliance | 0.005 | SW-846 9010, 9012 | Colorimetric/Spectrophotometric (Manual Distillation followed by Analysis) |
| SS06B014 | 10-87-7 | Cyanide, Amenable to Chlorination | 0.005 | EPA 335.1, SM4500-CN G | Colorimetric/Spectrophotometric |
| SS06B015 | 10-87-7 | Cyanide, Amenable to Chlorination, for RCRA Compliance | 0.005 | SW-846 9010A & 9012 | Colorimetric/Spectrophotometric |
| SS06B016 | Inactive | Inactive | Inactive | Inactive | Inactive |

Table C1 WATER QUALITY PARAMETERS (continued)

| Line Item Codes | Parameter Identifier | Parameter Name | RDL(1) (mg/L) | Approved Methods (2) | Method Type |
|-----------------|----------------------|--|------------------|--|--|
| SS06B017 | 10-71-9 | Cyanide, Releasable, for RCRA Compliance | 0.005 | SW-846 Chapter 7, SW-846 9010A, & 9012 | Colorimetric/Spectrophotometric (Distillation followed by Analysis) |
| SS06B018 | 16984-48-8 | Fluoride | 0.5 | EPA 300.0 | Ion Chromatography |
| | | | | EPA 340.2, SM4500-F B, C | Potentiometric (Distillation followed by ISE) |
| SS06B019 | 11-02-9 | Hardness as CaCO ₃ | 10 | EPA 130.2, SM 2340C | Titrimetric |
| SS06B020 | 14797-55-8 | Nitrate as N | 0.5 | EPA 300.0 | Ion Chromatography |
| | | | | EPA 352.1, EPA 353.1, 353.2, | Colorimetric/Spectrophotometric (Brucine sulfate) (NO ₃ /NO ₂ less 2 NO ₂) |
| SS06B021 | 14797-65-0 | Nitrite as N | 0.5 | EPA 300.0 | Ion Chromatography |
| | | | | EPA 354.1, SM4500-NO ₂ ⁻ B, EPA 353.1, 353.2, 4500-NO ₂ ⁻ E, H | Colorimetric/Spectrophotometric (Without reduction) |
| SS06B022 | C-005 | Nitrate/Nitrite as N (Total Nitrate/Nitrite as N) | 0.05 | EPA 353.1, SM4500-NO ₃ ⁻ H, EPA 353.2, 4500-NO ₃ ⁻ E | Colorimetric/Spectrophotometric (Auto Hydrazine) (Cadmium Reduction) |
| SS06B023 | 10-30-0 | Oil and Grease, Total Recoverable | 5 | EPA 413.1, EPA 413.2 | Gravimetric Extraction |
| SS06B024 | 11-59-6 | Organic Carbon, Dissolved (DOC) | 1.0 | EPA 415.1 | IR |
| SS06B025 | 10-35-5 | Organic Carbon, Total (TOC) | 1.0 | EPA 415.1, SM5310 B, C, D | IR |
| SS06B026 | 10-29-7 | pH (Hydrogen Ion) | 0.1 S.U. at 25°C | EPA 150.1, SM4500-H ⁺ B, SW-846 9040 (water), SW-846 9045A (soil) | Potentiometric |
| SS06B027 | 108-95-2 | Phenol | 0.1 | EPA 420.1, SM 5530D | Colorimetric/Spectrophotometric |
| SS06B028 | 14265-44-2 | Phosphate (ortho) as P (Ortho Phosphate) | 0.01 | EPA 365.1, .2, .3, SM4500-P F, E | Colorimetric/Spectrophotometric |
| | | | | EPA 300.0 | Ion Chromatography |
| SS06B029 | 7723-14-0 | Phosphate (total) as P | 0.01 | EPA 365.1, .2, .3 SM4500-P B,5 | Colorimetric/Spectrophotometric (Persulfate digestion followed by OrthoPhosphate Analysis) |
| SS06B030 | See Table C-2 | Sediment Analysis, Sand-Silt Split | N/A | ASTM D422 & D4822, USGS (3) | Gravimetric |
| SS06B031 | 7631-86-9 | Silica as SiO ₂ , Dissolved | 5 | EPA 370.1, SM4500-Si D | Colorimetric/Spectrophotometric |
| SS06B032 | 11-06-3 | Solids, Non-Volatile Suspended (NVSS), (Non-Filterable Residue at 550°C) | 5 | EPA 160.4, SM2540 E | Gravimetric (TSS-VSS) |
| SS06B033 | C-008 | Solids, Total (TS) (Total Residue at 103°C to 105°C) | 10 | EPA 160.3, SM2540 B | Gravimetric |
| SS06B034 | 10-33-3 | Solids, Total Dissolved Solids (TDS), (Filterable Residue at 180°C) | 10 | EPA 160.1, SM2540 C | Gravimetric |

Table C1 WATER QUALITY PARAMETERS (continued)

| Line Item Codes | Parameter Identifier | Parameter Name | RDL ⁽¹⁾ (mg/L) | Approved Methods ⁽²⁾ | Method Type |
|-----------------|----------------------|---|------------------------------|---|---|
| SS06B035 | 10-32-2 | Solids, Total Suspended (TSS) (Non-Filterable Residue at 103°C to 105°C) | 5 | EPA 160.2, SM2540 D | Gravimetric |
| SS06B036 | 10-34-4 | Specific Conductance (Conductivity) | 10 mmho/cm at 25°C | EPA 120.1, SM 2510 B | Potentiometric |
| SS06B037 | 14808-79-8 | Sulfate as SO ₄ ²⁻ | 5.0 | EPA 375.1, EPA 375.2 SW846-9035 & 9036 | Colorimetric/Spectrophotometric |
| | | | | EPA 300.0 | Ion Chromatography |
| SS06B038 | RFS-RS-97 | Sulfide as H ₂ S, Releasable, for RCRA Compliance | 1 | SW846 Chapter 7, SW-846 9030A | Titrimetric (Distillation followed by Analysis) |
| SS06B039 | 18496-25-8 | Sulfide as S | 0.002 | EPA 376.1, 2 SM4500-S ²⁻ E ⁽⁴⁾ | Colorimetric/Spectrophotometric (Gas Dialysis, Automated Methylene Blue Method) |
| SS06B040 | 7727-37-9 | Total Kjeldahl Nitrogen (TKN) (Organic Nitrogen as N) | 0.2 | EPA 351.1, 351.2, 351.3, 351.4 SM4500-NH ₃ | Colorimetric/Spectrophotometric (Preparation followed by Ammonia as N) |
| SS06B041 | 59473-04-0 | Total Organic Halides (TOX) | 1.0 | SW-846 9020 | TOX |
| SS06B042 | 10-90-2 | Total Petroleum Hydrocarbons (TPH) | 1.0 | EPA 418.1, SM-5520 F | IR |
| SS06B043 | 10-08-02 | Turbidity | 1.0 NTU | EPA 180.1, SM2130 B | Turbidimetric (Nephelometric) |

- (1) RDLs (Required Detection Limits) listed in Table C1 specify maximum allowed levels for MDLs. See SS06 Exhibit D Section 11.
- (2) It is the responsibility of the Laboratory to assure that the method appropriate to the sample matrix and RDL is chosen from the specified method source. The most recently promulgated version should be used unless a specified version requested. The referenced SM methods are from the 18th edition of *Standard Methods for the Examination of Water and Wastewater*.
- (3) 'Laboratory Theory And Methods For Sediment Analysis, Chapter C1 of Techniques of Water-Resources Investigations of the United States Geological Survey,' 1969; Harold P. Guy, U.S. Geological Survey.

'Quality-Assurance Plan For The Analysis Of Fluvial Sediment By Laboratories Of The U.S. Geological Survey,' *U. S. Geological Survey Open-File Report 91-467*, Wilbur J. Matthes, Jr., Clyde J. Sholar, and John R. George, U. S. Geological Survey,
- (4) This referenced SM method is from the 19th edition of *Standard Methods for the Examination of Water and Wastewater*.

APPENDIX B

Field Forms

Soil & Water Database (SWD)

Report Date: 22-DEC-98

Field Event (SWDF_1100)

Sample Contractor: AS
Collection Date/Time: 23-DEC-98Sampler1: _____
Sampler2: _____
Sampler3: _____

Sample Event #: 89D4351-001

Sample Type: SW

Project: NPDES

Disposition: _____

Location: 995 EFF

Sample QC: REAL

Result Expected: YES

Sample QC Partner: _____

Event Comment: _____

| Field Measurement | Result | Unit | Derivation Code | Derivation Comment |
|-------------------|--------|----------|--------------------|--------------------|
| DO | _____ | mg/L | DR2000 | _____ |
| PH | _____ | S.U. | HORIBA | _____ |
| TEMP(AIR) | _____ | C | VWR THERMOMETER | _____ |
| TEMP(H2O) | _____ | C | HORIBA | _____ |
| TRC | _____ | mg/L | DR2000 | _____ |
| OIL/GREASE | _____ | NO UNITS | VISUAL | _____ |
| FLOW | _____ | NO UNITS | VISUAL | _____ |

| Line Item | Bottle Disposition | Collection Date/Time | Bottle Type Volume | Preservative | Field Filtered | Matrix |
|------------------------|--------------------|-----------------------------------|--------------------|--------------|----------------|--------|
| 88068008 OBOD | _____ | _____ | _____ | _____ | _____ | _____ |
| Lab: ACCU | | RIN-Event.Bottle: 89D4351-001.001 | | | | |
| Shipment Date: _____ | | Bottle Comment: _____ | | | | |
| Turnaround Time: _____ | | | | | | |

QC Signature/Date: _____

Last Date Updated: 22-DEC-98

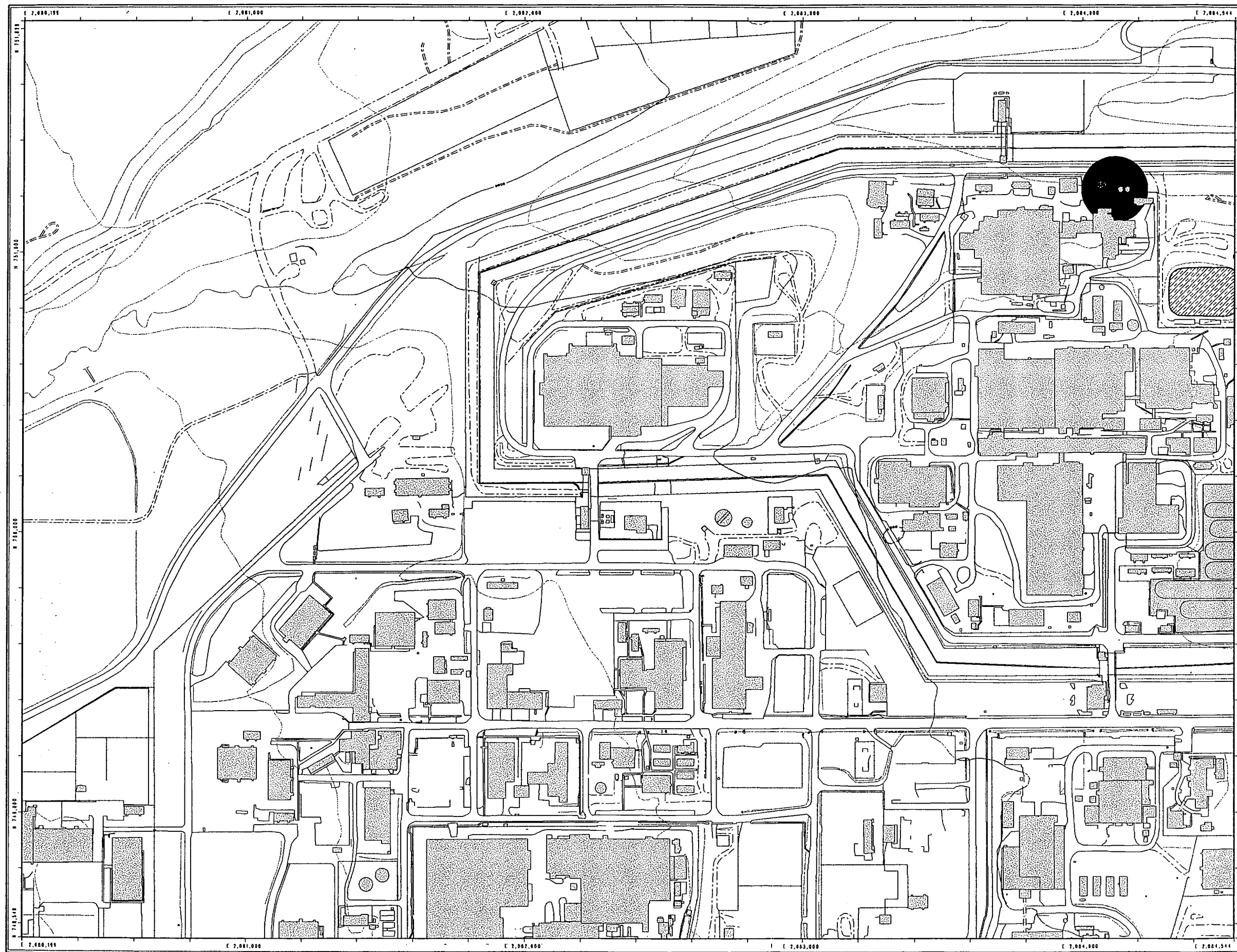
BOWMANS POND SAMPLE CORRELATION FORM

LOGBOOK: ER-PAC1108-LB-99-426

PAGE __ OF __

DATE: _____
RIN#: 99A _____INVESTIGATION AREA: _____
SAMPLERS: _____QC/PEER REVIEW: _____
Print/Sign/Date

| Time | Event | Bottle | Analysis | Location Code | QC | Assoc. RadS Event/Bottle | Assoc. QC Event/Bottle | Total Activity |
|------|-------|--------|-------------------------------|---------------|--------------------|-----------------------------|---------------------------|-------------------|
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |
| | | | VOA Rad RadS SVOCs Met PCB | | Real TB Rns DUP | | | |



Location Map

Figure 1.1

Bowman's Pond (PAC-700-1108) and
Steam Condensate Holding Tanks (IHSS 139.1N)

EXPLANATION

- Investigation Area
- Standard Map Features**
- ▒ Buildings and other structures
- ▨ Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- - - Fences and other barriers
- Contour (20-Foot)
- == Paved roads
- - - Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data acquired by ES&G RSL, Las Vegas. Digitized from the orthophotograph, 1:25 Topographic (contours) were derived from digital elevation model (DEM) data by Mountain Resources (MR) using ESRI Arc TIN and LANTICE to process the DEM data to create 5-foot contours. The DEM data was acquired by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at 1:10 meter resolution. DEM post-processing performed by MR, Winter 1997.



Scale = 1 : 4230
1 inch represents approximately 353 feet



State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

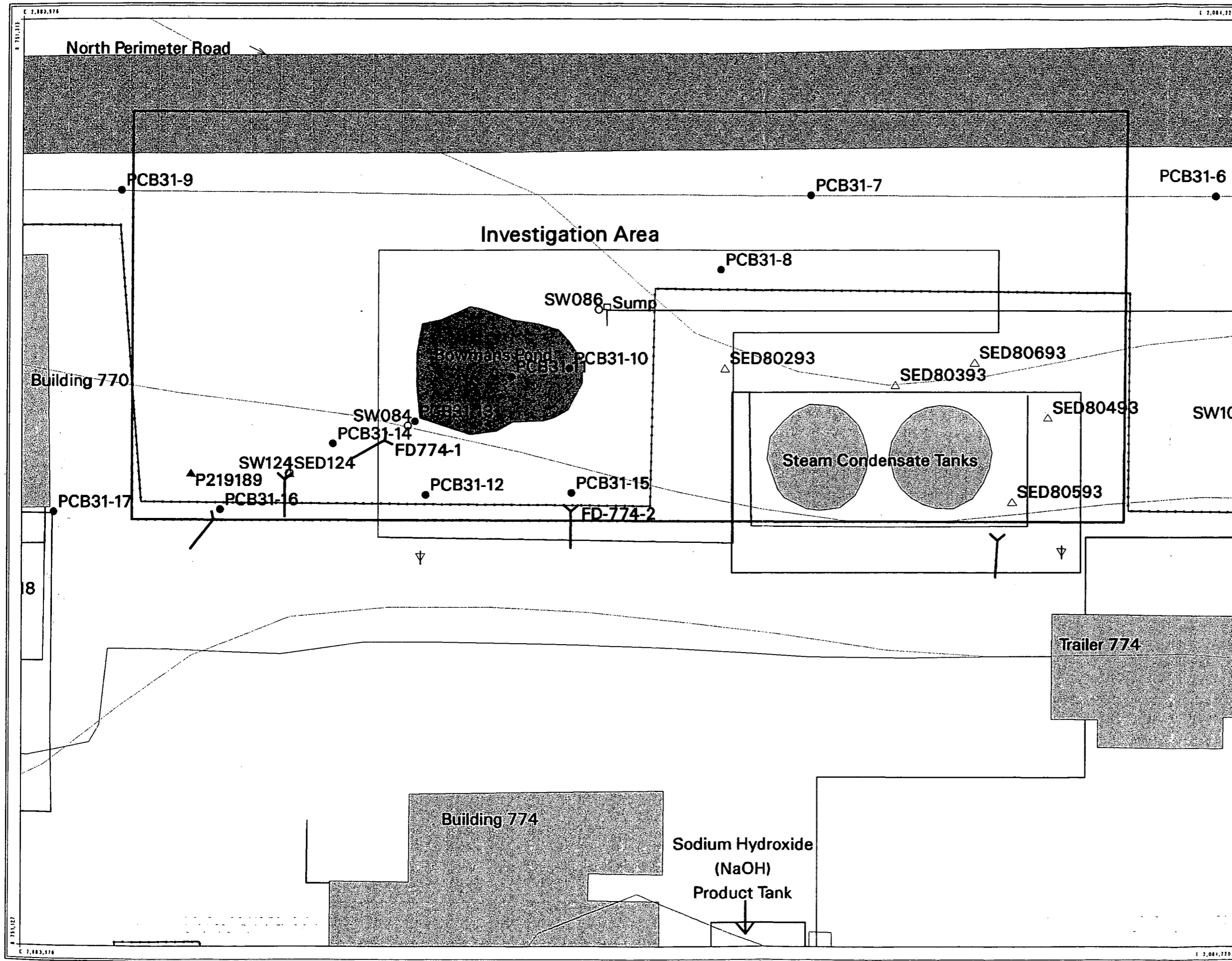
U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain
Remediation Services, LLC.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 454
Golden, CO 80402-4454

MAP ID: 99-0088

April 13, 1999

NT_Srv w:\projects\1999\99-0088\bowman_loc.aml



Sample Location Map
Figure 1.2
 Bowman's Pond (PAC-700-1108) and
 Steam Condensate Holding Tanks (IHSS 139.1N)

EXPLANATION

- PCB Samples
- ▲ Groundwater Well Locations
- Surface Water Locations
- △ Sediment Sample Locations
- PAC-700-1108 Boundary
- Fence Line
- Investigation Area
- Footing Drain Outlet

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Contour (5-Foot)
- Paved roads
- Dirt roads



Scale = 1 : 230
 1 inch represents approximately 19 feet



State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

U.S. Department of Energy
 Rocky Flats Environmental Technology Site

Prepared by:



Rocky Mountain Remediation Services, L.L.C.
 Geographic Information Systems Group
 Rocky Flats Environmental Technology Site
 P.O. Box 484
 Golden, CO 80402-0484

MAP ID: 99-0059

April 13, 1999

fig2/projects/ryse/99-0059/ryse_pao.aml

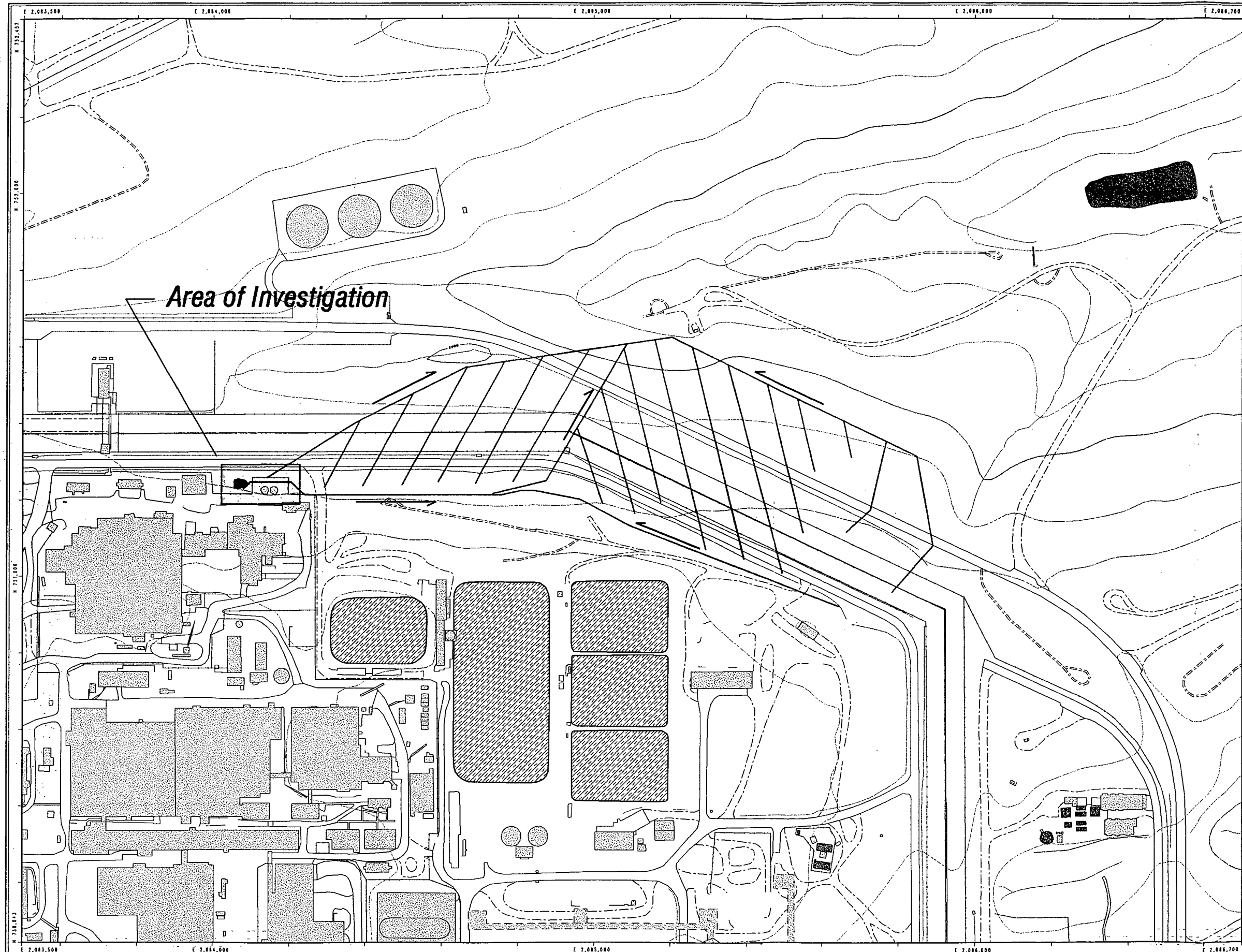


Figure 1.3
Location of Groundwater Interceptor Trench System (ITS)

EXPLANATION

Study Area Features

- Direction of Groundwater Flow
- ∩ Interceptor Trench System
- Bowman's Pond
- Area of Interest

Standard Map Features

- Buildings and other structures
- ▨ Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (20-Foot)
- Paved roads
- Dirt roads

DATA SOURCE:
 Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by ECHS RSI, Las Vegas. Digitized from the orthophotographs. 1/96 Topology (contours) were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~ 10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Scale = 1 : 3120
 1 inch represents 260 feet



State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

U.S. Department of Energy
 Rocky Flats Environmental Technology Site

Prepared by:

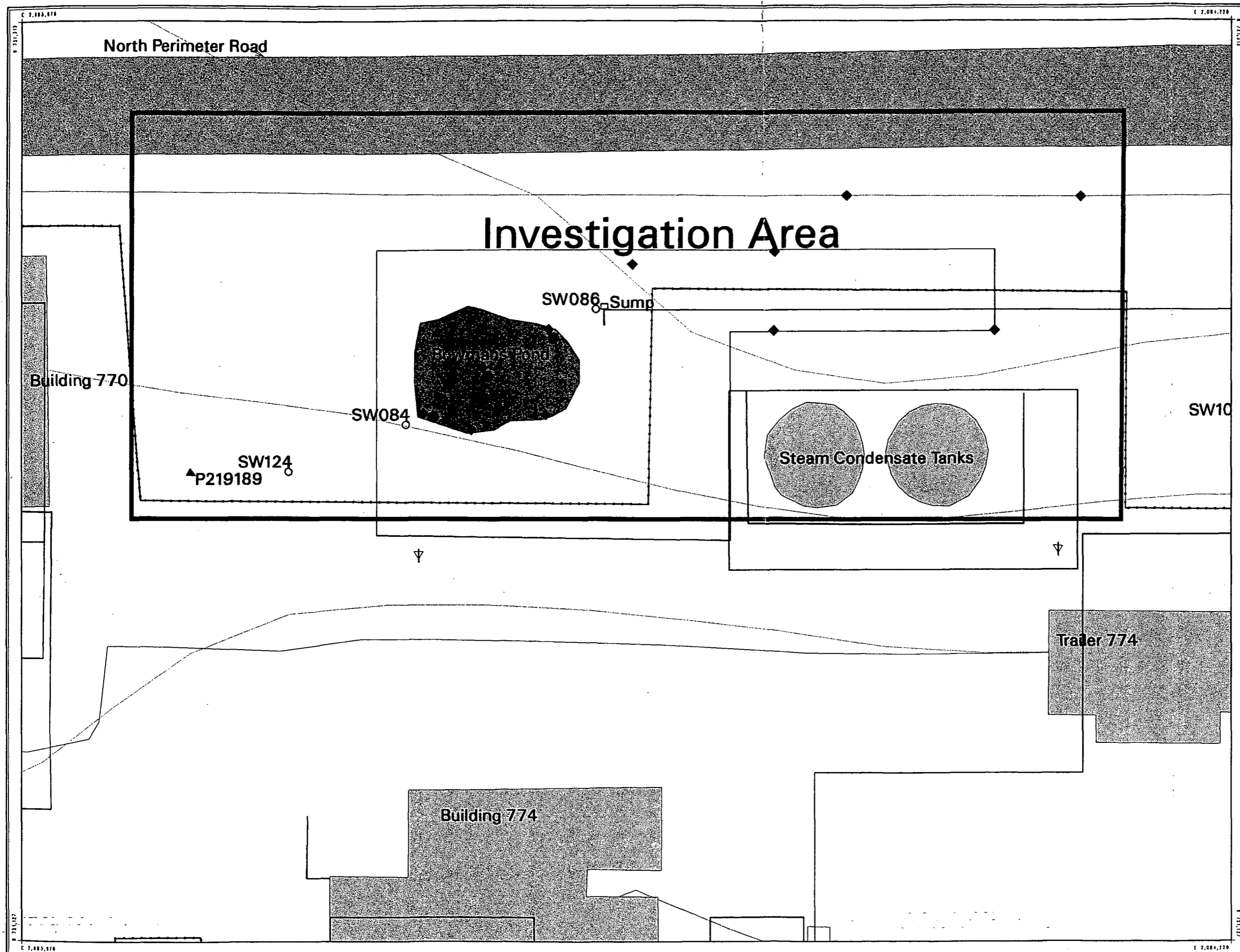


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MAP ID: 99-0218

March 20, 1999

NT_Srv_w:\projects\99\99-0218\its-trench.aml



Proposed Sample Location Map

Figure 3.1

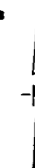
Bowman's Pond (PAC-700-1108) and
Steam Condensate Holding Tanks (IHSS 139.1N)

EXPLANATION

- ▲ Groundwater Well Locations
- Surface Water Locations
- Proposed Boreholes
- Proposed Surface Water Sample Locations
- PAC-700-1108 Boundary
- Fence Line
- Investigation Area

Standard Map Features

- Buildings and other structures
- ▨ Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Paved roads
- Dirt roads



Scale = 1 : 230
1 inch represents approximately 19 feet

0 10 20ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
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April 14, 1999